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El papel del cambio institucional en la gestión de recursos de propiedad común: la cuenca del Nilo

The role of institucional change in the management of common-pool resources: the Nile Basin

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LIST OF UNITS OF MEASUREMENT

Water

m^3	cubic metre = 1,000 litres = 35.315 cubic feet
mcm	million cubic metres
bcm	billion cubic metres
asl	above sea level

Land

A feddan is a unit of measurement of the land area in Egypt and Sudan

1 feddan = 24 qirat = 1.038 acres = 0.42 hectares

Power

kW	kilowatt	= 10^3 watts
MW	megawatt	= 10^6 watts or 1 000 kW
GW	gigawatt	= 10^9 watts or 1 000 000 kW
kWh	kilowatt hour	one kW for the period of one hour
MWh	megawatt hour	one MW for the period of one hour or 1 000 kW.h
GWh	gigawatt hour	one million kW for the period of one hour

LIST OF ACRONYMS

AU	African Union
CA	Capability Approach
CFA	Common Framework Agreement
COMESA	Common Market for East Africa
EP	Egyptian Presidency
FAO	Food and Agriculture Organisation of the United Nations
GDP	Gross Domestic Product
GOE	Government of Egypt
GOUAR	Government of The United Arab Republic (Egypt)
HYDROMET	Hydromateriological Survey of the Catchments of Lakes Victoria, Kyoga, and Mobutu
ILC	International Law Commission
IMF	International Monetary Fund
IWMI	International Water Management Institute
KBO	Kagera Basin Organisation
MDGs	Millennium Development Goals
MOTS	Ministry of Trade and Supply
MOE	Ministry of Education
MWRI	Ministry of Water Resources and Irrigation
MOH	Ministry of Health
NBI	Nile Basin Initiative
NIE	New Institutional Economics
NGOs	Non-governmental Organisations
OAU	Organisation of African Unity
PJTC	Permanent Joint Technical Commission on the Nile
RBO	River Basin Organisation
TECCONILE	Technical Cooperation Committee for Promotion of Development and Environmental Protection of the Nile

	Basin
UAR	United Arab Republic (Egypt)
UK	United Kingdom
UN	United Nations
UNDP	United Nations Development Program
UNEP	United Nations Environmental Program
UNESCO	United Nations Educational, Scientific and Cultural Organization
UN-Water	United Nations inter-agency coordination mechanism for all freshwater and sanitation related matters
USA	United States of America
USAID	United States Agency for International Development
WHO	World Health Organisation
WMO	World Meteorological Organisation
USD	United States Dollar

RESUMEN EJECUTIVO

El objetivo de la presente investigación es estudiar el papel del cambio institucional en la administración de recursos comunes. La evolución del régimen de gestión de la Cuenca del Nilo y su impacto en la subsistencia del pueblo egipcio es el caso sometido a estudio. Un contenido más específico ahonda en la identificación de las dinámicas de desarrollo de los convenios institucionales que han regido la Cuenca del Nilo en el periodo entre 1882 y 2014. Además, explora el impacto de un marco nacional que regula la distribución de los beneficios de los recursos hídricos entre diferentes clases sociales.

En general, los convenios institucionales de un grupo regulan su interacción con una sociedad o comunidad (North, 1990). Dichos convenios se dividen en instituciones formales e informales (North, 2008). Las instituciones formales comprenden reglas escritas que gobiernan el grupo, mientras que las instituciones informales se refieren a las convenciones y códigos no escritos que controlan la interacción del grupo. La investigación se centra en el papel de las instituciones de la Cuenca del Nilo a dos niveles: a nivel de la propia cuenca y a nivel de Egipto como nación. En el primer nivel estudia el impacto de las instituciones en la interacción estratégica entre los países ribereños, que condujo al desarrollo del actual régimen de gobierno del Nilo. En el segundo nivel el análisis rastrea la influencia del marco institucional egipcio en la canalización de los beneficios a diversas clases sociales del país llevada a cabo por los sucesivos regímenes.

La historia de la Cuenca del Nilo, y su importancia, han llevado a los investigadores a analizar la región desde diferentes perspectivas. Sin embargo, a nivel de la cuenca, la existencia de persistentes tensiones entre los países a orillas del Nilo ha animado a los expertos a redirigirse hacia la teoría de juegos y analizar así las interacciones estratégicas entre estos países. A nivel de Egipto como nación, un buen número de estudios han analizado ya los impedimentos tanto institucionales como organizacionales que han obstaculizado el desarrollo de su sector hídrico y sus potenciales reformas. Sin embargo, ninguno de ellos ha

examinado las dinámicas de desarrollo del régimen de gestión de la Cuenca del Nilo, o rastreado su impacto en la subsistencia del pueblo egipcio.

Para completar este vacío, la presente investigación despliega un marco analítico a dos niveles para estudiar la interacción estratégica entre países ribereños que ha desarrollado el régimen de gestión de la Cuenca del Nilo. Además, dicho marco dual examina la influencia de la regulación egipcia en la distribución de los beneficios del agua atribuidos a diferentes segmentos de población en Egipto. Concretamente se utiliza un marco institucional combinado que integra los modelos de la Nueva Economía Institucional con el enfoque de las capacidades para analizar el ámbito institucional que ha gobernado la Cuenca del Nilo y su impacto en la población egipcia.

La hipótesis del estudio es que las instituciones informales han dificultado la cooperación entre los países ribereños. Las conclusiones extraídas del análisis realizado confirman que dichas instituciones son uno de los principales determinantes de los resultados de los intentos de cooperación inter-ribereña. Aunque las instituciones informales han jugado papeles positivos en algunos de los esfuerzos de cooperación entre estas naciones, el efecto general ha sido negativo. La colonización británica de la mayoría de los países de la Cuenca del Nilo desde el principio del periodo de estudio hasta la década de los 50 atenuó el impacto negativo de las instituciones informales en la interacción entre estos países durante dicho periodo. Sin embargo, desde 1950, las instituciones informales solo han tenido un impacto positivo en la interacción estratégica entre Egipto y Sudán. Pero, desde el punto de vista negativo, han contribuido al fracaso de las grandes interacciones entre Egipto y los otros dos países ribereños estudiados, a saber Etiopía y Uganda. Es más, han sido una de las principales causas del punto muerto en el que se encuentra la Cuenca del Nilo. Con respecto al impacto del marco institucional nacional de los beneficios hídricos concedidos al pueblo egipcio, se deduce que los beneficios del agua del Nilo han sido encauzados hacia diferentes segmentos de población, determinados por diferentes niveles de dicho marco. El marco institucional egipcio ha favorecido a hacendados y a la clase capitalista durante la mayoría del periodo de estudio. La única excepción fue el periodo de las décadas de

1950 y 1960, cuando el régimen egipcio se embarcó de manera progresiva en un cambio institucional que promovió una distribución más equitativa no solo de los beneficios de los recursos hídricos sino también de la riqueza nacional entre la totalidad de la población.

Esta tesis contribuye a alcanzar una mayor comprensión de las dinámicas de desarrollo de la gestión transfronteriza del agua del Nilo. En segundo lugar, resalta el impacto del marco regulatorio nacional en la distribución de los beneficios de los recursos hídricos entre los diferentes segmentos de población. Para terminar, el marco analítico combinado que incluye el estudio puede contribuir a completar la investigación de la relación entre la gestión de los recursos hídricos transfronterizos y la regulación del reparto nacional del agua. Además, podría ser útil para analizar el papel de los determinantes institucionales en otros tipos de regímenes de administración de recursos comunes.

The objective of this research is to investigate the role of institutional change in the common resources management. The evolution of Nile Basin management regime and its impact on the livelihood of the Egyptian people is chosen as the case to be studied. A more specific concern is to identify the dynamics of development of institutional arrangements governing the Nile basin during the period 1882-2014. Moreover, it explores the impact of the national regulatory framework on the distribution of the benefits of water resources among the different social classes.

In general, Institutional arrangements of a group refer to the rules that regulate the interactions in this society or community (North, 1990). The institutional arrangements are divided into formal and informal institutions (North, 2008). Formal institutions are the written rules that govern the group whereas informal institutions refer to the unwritten conventions and codes that control the interactions among this group. The research studies the role of institutions in the Nile basin on two levels: the basin-wide level and the Egyptian national level. On the basin-wide level, the research studies the impact of the institutions on the strategic interaction among riparian countries that led to the development of the current Nile water governance regime. On the Egyptian national level, the analysis traces the influence of national institutional framework on channelling the benefits allocated to Egypt by the successive Nile water governance regimes to the different social classes of Egyptians.

The history of the Nile basin and its importance has induced researchers to analyse the basin from various perspectives. However, At Basin-level, persistent tensions among Nile riparian countries have stimulated researchers to increasingly resort to game theory to analyse the strategic interactions among these countries. At the Egyptian national level, a number of studies has analysed the institutional and organisational impediments that curtail the water sector in Egypt and potential reforms. However, neither of these studies have studied the dynamics of the development of Nile Basin management regime and traced its impact on the

livelihood of the Egyptian people.

To fill this gap, this research develops a two-level analytical framework to analyse the strategic interactions among riparian countries that have developed the basin-wide management regime of the Nile. Moreover, the two-level framework examines the influence of the Egyptian regulatory framework on the distribution of Nile water benefits accrued to different segments of Egyptian population. More specifically, the research uses a merged institutional framework that integrates the models of the New Institutional Economics (NIE) with the capability approach to analyse the dynamics of the institutional settings that has governed the Nile basin and its impact on the Egyptian population.

The hypothesis of the research is that informal institutions have been prohibitive to cooperation among the riparian countries. The conclusions drawn from the analysis conducted confirms that institutions have been among the main determinants of the outcomes of cooperation attempts of the inter-riparian cooperation. Although the informal institutions have played positive roles in some cooperation efforts among riparian countries, its overall effect was negative. The British colonisation of the majority of the Nile Basin countries from the beginning of the study period until 1950s attenuated the negative impact of informal institutions on the interactions among the riparian countries during this period. However, since 1950s, informal institutions had positive role only in the strategic interactions between Egypt and Sudan. On the negative side, it contributed to the failure of the major interactions between Egypt and the other two studied riparian countries, namely Ethiopia and Uganda. Moreover, it has been among the main causes of the current deadlock in the Nile basin. With regard to the impact of the national institutional framework on the water-related benefits accrued to Egyptian people, it has been found that the Nile water benefits channelled to the different segments of the population have been significantly determined by the different levels of national institutional Framework. The Egyptian institutional Framework have been biased to landowners and capitalist classes during most of the study period. The only exception was the period 1950s-1960s when the Egyptian regime embarked in a progressive institutional change that established an institutional framework that

promoted more equal distribution not only of water resources benefits but also of whole national wealth among the different segments of population.

This thesis contributes to achieve a better understanding of the dynamics of the development of transboundary management of Nile water. Secondly, it highlights the impact of the national regulatory framework on the distribution of the benefits of water resources among the different segments of population. Finally, the merged analytical framework introduced in the study can contribute to the literature that investigates the relation between transboundary water resources management and riparian countries' regulation of their national shares of this water. Moreover, it can be employed to analyses the role of institutional determinants in other types of common resources management regimes.

CHAPTER 1

BACKGROUND AND MOTIVATION FOR THE STUDY

This chapter provides general background for the topic of the research and the motivations for conducting it. The chapter is structured in four sections. The first section briefly provides an introduction about the importance of water and its distinctive features as a natural resource. Consequently, the second section analyses the water challenge faced by the world in general and by Africa and the Nile Basin countries in particular. The third part identifies the potential for cooperation and conflict among riparian countries in their attempts to overcome this challenge. Finally, the motivation for conducting this study and a brief idea about the research methodology and hypothesis is presented.

1 Introduction

Water is considered as one of the most precious natural resources. The most distinctive feature of water is that it is a natural resource that is part and parcel of all aspects of human existence. Its importance stems from the fact that it is not only a biological need of human beings but also it is an integral part of all human activities. All productive sectors depend on water as an essential element of their processes. Moreover, developing countries are increasingly using their water resources for power generation which is essential for economic development (Scheumann & Neubert, 2006). Furthermore, water is not only essential for the economic dimension of development but it is also a crucial social dimension of development. Social justice implies some basic rights for citizens that include the social minimum entitlements, fair distribution and equality of opportunity (UNDP, 2006). Reliable access to safe water that can meet their basic needs is a social minimum that should be guaranteed to every citizen. Fair redistribution of social wealth implies investing in providing people with clean and productive water that allows them to lead a decent productive life. Equally important, water is necessary for both healthcare and education which are the two most effective mechanisms of governments for promoting equality of opportunity among citizens. Therefore, it is not surprising that the United Nations decided in 2003 to declare the period 2005–2015 as International Decade for Action “Water for Life” to support the efforts of the least

developed countries to achieve the Millennium Development Goals (MDGs) because many of them are strongly linked to the availability of sustainable water resources.

Water is also different from any other resource in some important aspects. First, it is a finite resource that has no substitute. Moreover, water is a flowing resource that traverses places, regions and even countries. Therefore, its use in any one region or country affects its use in other regions and countries (UNDP, 2006). These aspects of scarcity and interdependence among water-sharing regions and nation states have created problems of water resources around the world.

2 Fresh Water Challenge

2.1 Global Water Challenge

2.1.1 Global Water Scarcity Problem

Although water covers more than two-thirds of the earth, fears of water scarcity have been intensified during the last decades. The competition for water is expected to escalate not because the world is running of water but because water resources are not equally distributed. A significant portion of the world population lives in areas that face increasing water scarcity challenges. Around 1.4 billio people live in river basins that suffer from overuse of water resources; i.e. where water use exceeds water replenishment rate (UNDP, 2006). This overuse leads to the decline of the rivers' water levels, the depletion of groundwater reserves and the degradation of water-based ecological systems (UNDP, 2006). Water scarcity is aggravated by population growth, increasing urbanisation, uneven industrial growth, weak governance and climatic anomalies (UNESCO, 2006). Moreover, climate change will increase the pressure on water resources in various zones of the world as it is expected to affect both water availability and quality (UN-Water, 2008).

Even worse, it is estimated that developing countries will face the highest water-related pressures. The low technology level of these countries forces them to use their water resources in the high water consuming, low productivity agricultural sector (Jägerskog & Phillips, 2006). This makes them more vulnerable to

fluctuations in water resources. Furthermore, their growing populations, increasing urbanisation and industrial development require more water resources (UN-Water, 2008). Therefore, falling water resources will not only hamper their efforts to achieve higher levels of economic development but it will also challenge their capacity to maintain the current modest level of development.

Digging deeper to have a closer look on the distribution and use of water resources all over the world, it becomes imperative to resort to some water resource indicators. In this regard, two indices are most commonly used; the Falkenmark indicator and the International Water Management Institute (IWMI) index.

2.1.1.1 Water Stress Indicator

The term water stress refers generally "the ratio of water use (i.e. the amount of water withdrawn from the natural hydrological system) over the total amount of renewable water available" (UNESCO, 2012). Based on extensive study of the water consumption patterns of many countries, Falkenmark (1989) has developed a water stress indicator that relates available water resources to the number of individuals relying on these resources. The basic idea is that as long as climate does not change, the average annual water flow in a given country is nearly constant in spite of the fluctuations between wet and dry years (Falkenmark & Widstrand, 1992). Therefore, the degree of water scarcity in a given country is a function of the water resources available to that country and population pressure (Falkenmark & Widstrand, 1992). Based on this relation, Falkenmark proposes the use of any country of 100% of its annual water resources as the water barrier. Consequently, he identifies the different levels on the scale of the indicator (Falkenmark, 1989).

There are two ways to express this indicator. The first formula, which was used by Falkenmark himself, is to determine the number of individuals who are dependent on one water flow unit, where one flow unit is defined as one million cubic metres per year (Falkenmark, 1989). The second formula, which has been widely used in the literature, is to define the average fraction of the total water runoff, expressed in cubic metres, which is available to an individual per year (Brown & Matlock, 2011). According to Falkenmark and Widstrand (1992), if the number of

individuals depending on one million cubic metres per year is below 100 then water resources are abundant. Moreover, if the population per water flow unit increases without exceeding 300 persons per million cubic metres per year, there is no water stress but better water management is needed for assuring quality and equality of distribution. Water stress starts when the population per water flow unit reaches 600 persons per million cubic metres per year. When there are more than 1000 persons per million cubic metres, the country starts to suffer from water scarcity. Finally when a country has more than 2000 persons per million cubic metres of water per year, the country suffers from extreme or absolute water scarcity. These levels have been interpreted using the second formula of the indicators into the categories shown in Table 1-1.

Total water per person per year	Condition
More than 1700 m^3/person	no water stress
From 1000 to 1700 m^3/person	water stress
From 500 to 1000 m^3/person	water scarcity
Less than 500 m^3/person	absolute/extreme water scarcity

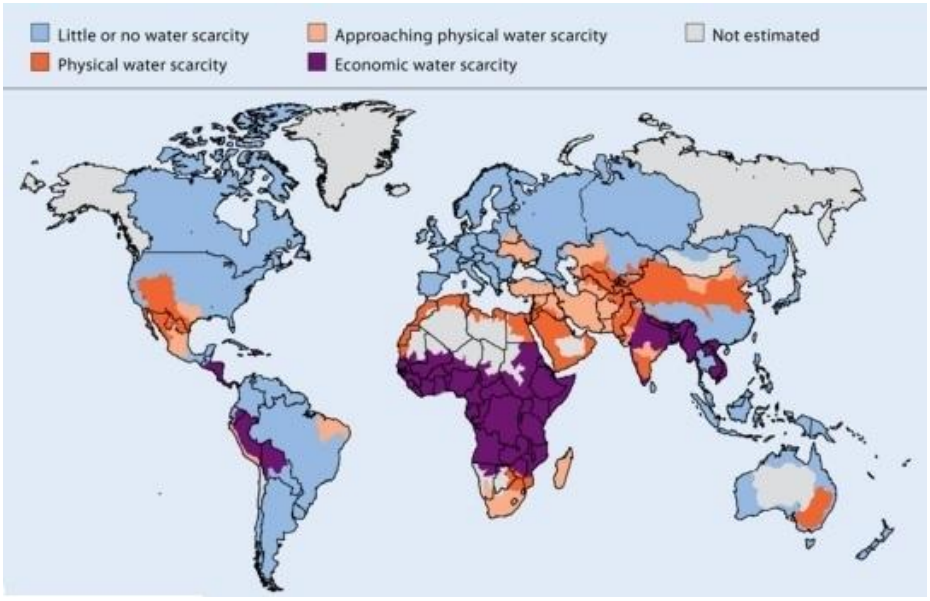
Table 1-1: Categories of water scarcity according to Falkenmark's index.

Most countries were surveyed and the water usage per person in each was calculated and presented by Falkenmark and Widstrand (1992) using the first formula of the Falkenmark indicator. It has been found that many countries in Africa and Asia will experience water stress and scarcity conditions during the next few decades as a result of the increasing population growth. It is expected that over 1 billion persons in Africa and Sothern Asia will suffer from water scarcity by the year 2025. By the same year, it is estimated that all North African and many Middle Eastern countries will face the condition of absolute water scarcity. Almost all the Middle Eastern countries have already passed the water barrier and are using more than 100% of their total renewable water resources (UNDP, 2006). Many of the African countries which are already suffering from water stress conditions will be

moving to water scarcity conditions. Examples of these countries and their water stress indicators in 2025 include: Somalia (2140 persons/million m^3); Kenya (4130 persons/million m^3) and Libya (18,400 persons/million m^3).

2.1.1.2 Water Scarcity Index

Water scarcity is defined as "the point at which the aggregate impact of all users impinges on the supply or quality of water under prevailing institutional arrangements to the extent that the demand by all sectors, including the environment, cannot be satisfied fully" (UNESCO, 2012). Therefore, while *water stress* is an absolute physical concept, *water scarcity* is a relative measure that combines physical and economic attributes. Physical water scarcity, or first-order water scarcity, refers to the physical shortage of water resources itself. On the other hand, economic scarcity, or second-order scarcity, refers to the capacity to mitigate the conditions of the physical scarcity (Jägerskog & Phillips, 2006).



Map 1-1: Classification of regions according to water scarcity (IWMI, 2007)

The International Water Management Institute (IWMI) uses a similar water scarcity assessment but differentiates between physical scarcity of water and economic scarcity of water. IWMI conducts on a regular basis a large-scale study of renewable freshwater resources available for human use and the available water

infrastructure (Brown & Matlock, 2011). Under the IWMI index countries are classified into: no or little water scarcity; physically water-scarce; approaching physical water scarcity; and economically water-scarce (IWMI, 2007). Countries with little or no water scarcity are countries that are rich in water resources so that they utilise and withdraw less than 25% of their water resources for human uses. Countries are classified as physically water-scarce when their use and withdrawal of their water resources is more than 75% of their water flows for human purposes. These countries are considered as approaching or having already exceeded sustainable limits of water resource utilisation. Moreover, countries are approaching physical water scarcity when they use and withdraw more than 60% of their waters flows. Finally, Countries are categorised as economically water scarce when their water withdrawal is less than 25% of their water flows due to their limited human, institutional, and financial capacity. The last survey conducted by IWMI that has been published (2007) resulted in a classification (Map 1-1) similar to that of Falkenmark. According to the IWMI survey, North African and Middle Eastern countries are already physically water-scarce. Moreover, almost all African countries fall in either the physically water-scarce category or in the economically water-scarce category.

2.1.2 Global Transboundary Water Challenge

This water challenge will be manifested in the competition between different uses of water, such as: urban uses versus rural consumption; present uses versus future demands, and the needs of different regions (UNESCO, 2006). This can give rise two potential patterns of conflicts. Firstly, national conflicts over water resources might erupt between conflicting demands. In any country, water creates human interdependence as it represents a shared resource that underpins households, livelihoods and the environment. Strong national governance bodies and sound legislative and legal systems can provide mechanisms that strike a balance among competing users (UNDP, 2006). Otherwise, the water rights and entitlements of the weakest people will be captured by the powerful groups and individuals. Secondly, as water is a fugitive resource that traverses frontiers it

creates hydrological interdependence between countries which can give rise to cross-border conflicts (UNDP, 2006).

Shared rivers have been always a potential source of competition. The English language, as well as many other Latin-rooted languages, reflects this relation between rivers and competition as it uses the word “rival” to refer to a competitor against others. The word “rival” comes originally from the Latin word “rivalis” that refers to an individual using the same river stream as another and originated from the Latin word “rivus” meaning river stream (Turnbull, 2010). Transboundary rivers are more complicated because the ways one riparian country use its water affect its use in other countries. These cross-border effects are transmitted through three mechanisms: competition for a finite supply of water; negative consequences on the quality of water; and impacts on the timing of water flows (UNDP, 2006). Drying rivers have harmful impacts on livelihoods. Furthermore, deteriorating water quality has negative effects on health conditions. Moreover, when changes in water flows experience unpredictable changes, the consequences of floods and droughts are exacerbated (UNDP, 2006). Therefore, the success of the riparian countries in developing joint governance mechanisms to manage the transboundary problem will not only bring peace to their regional relations but also will have a positive consequences for human development.

These cross-border effects usually create tensions between the societies that share rivers. Geographical and hydrological research indicates that the physical unity implies that a river basin must be governed as an indivisible unit, regardless of political divisions (UNESCO, 2006). However, transboundary water-use conflicts can only be settled through negotiations between sovereign states, unlike domestic tensions that are subject a higher-level state authority or by informal mechanism (Scheumann & Neubert, 2006). Conflicting interests can be solved only via cooperation among the riparian states to develop adequate joint legal and organisational frameworks for the basin management (UN-Water, 2008). However, as these tensions are not isolated from the wider context of relations between riparian countries, this context determines whether this hydrological interdependence will be a driver for peace or for conflict. Therefore, differences

between riparian states in the different dimensions of development, whether economic, social or political, usually represent challenges to effective and coordinated joint management of transboundary rivers (UN-Water, 2008). As a result, the international community has not yet developed sufficient international governance structures that can manage the transboundary river basin that cover significant areas of the globe. Thus, transboundary waters are expected be one of the biggest challenges for human development over the next decades. This challenge has two main dimensions: interdependence among the states sharing these international basins and water scarcity in these riparian states.

The magnitude of interdependence created by the transboundary water basins can be revealed by examining the state of international water basins. There exist at least 263 international water basins, representing nearly 50% of the land surface of the earth (UNDP, 2006). These transboundary basins represent approximately 60% of the whole freshwater resources available to living creatures in this world (Jägerskog & Phillips, 2006). Around 40% of the population of the world lives in these international basins; i.e., two of every five persons (UN-Water, 2008). More significantly, a total of 145 countries share water basins, accounting for more than 90% of the world's population (UNDP, 2006). Out of these basin-sharing countries, 30 countries lie entirely within these transboundary basins (UN-Water, 2008). Furthermore, 33 countries have more than 95% of their surface water resources in trans-boundary basins (Jägerskog & Phillips, 2006). Moreover, 39 states, whose total population is 800 million people, have at least 50% of their water resources originating beyond their borders (UNDP, 2006).

Another way to analyse the interdependence created by cross-border water among is to map the number of riparian countries in each international basin. Clearly, the challenge intensifies in the basins that have high number of riparian countries; the cross-border water challenge becomes more complicated in these basins. There are 19 international water basins that have five or more riparian states (Wolf, 2003). For example, one of these basins, the Danube, is shared by 17 riparian countries (Wolf, 2003). Another five basins, the Nile, Congo, Niger, Zambezi and Rhine have five or more riparian states. Finally, the other 13 basins have between five and eight

countries. This latter group of basins includes Jordan, Lake Chad, Tigris-Euphrates, Ganges-Brahmaputra-Meghna, Mekong, Tarim, Aral Sea, Neman, Kura-Araks, Volga, Vistula, La Plata and the Amazon (Wolf, 2003). Moreover, an extensive analysis shows that the scale of transboundary water is growing owing to the rise in the number of transboundary basins. The current number of basins, 263, has grown from 214 in 1978 mainly because of the break-up of the former Soviet Union and Eastern Europe states (Wolf, 2003). The increasing pressures on nation states, especially in the developing world, indicates that this number is expected to grow during the next few decades. Clearly, the higher the number of transboundary basins, the greater the challenges the world may face in the future.

2.2 Africa's Water Challenge

Nowhere is the complexity of water problem as evident as in the African continent. Africa suffers from a very complex water challenge that encompasses both dimensions of the problem: water scarcity and hydrological interdependence.

2.2.1 Water Scarcity in Africa

As indicated above, almost all African states suffer from either physical water scarcity or economic water scarcity. A seminal analysis conducted by Falkenmark (1989) reveals the severity of the water stress problem in the continent. He used a two-digit code system in which the number in the tens place is a water security index reflecting the needed increase in agricultural production to reach self-sufficiency whereas the number in the ones place is an index that mirrors his water stress indicator.

The water security index reflects the subsistence agricultural yield needed to reach self-sufficient agriculture. An index of 1 means that moderate growth in subsistence production is needed and an index of 5 means that large-scale irrigation-based agricultural production is needed. The water stress index reflects the level of water competition for populations predicted at the time of the study for the years 2000 and 2025 CE. This index follows the same classification of water

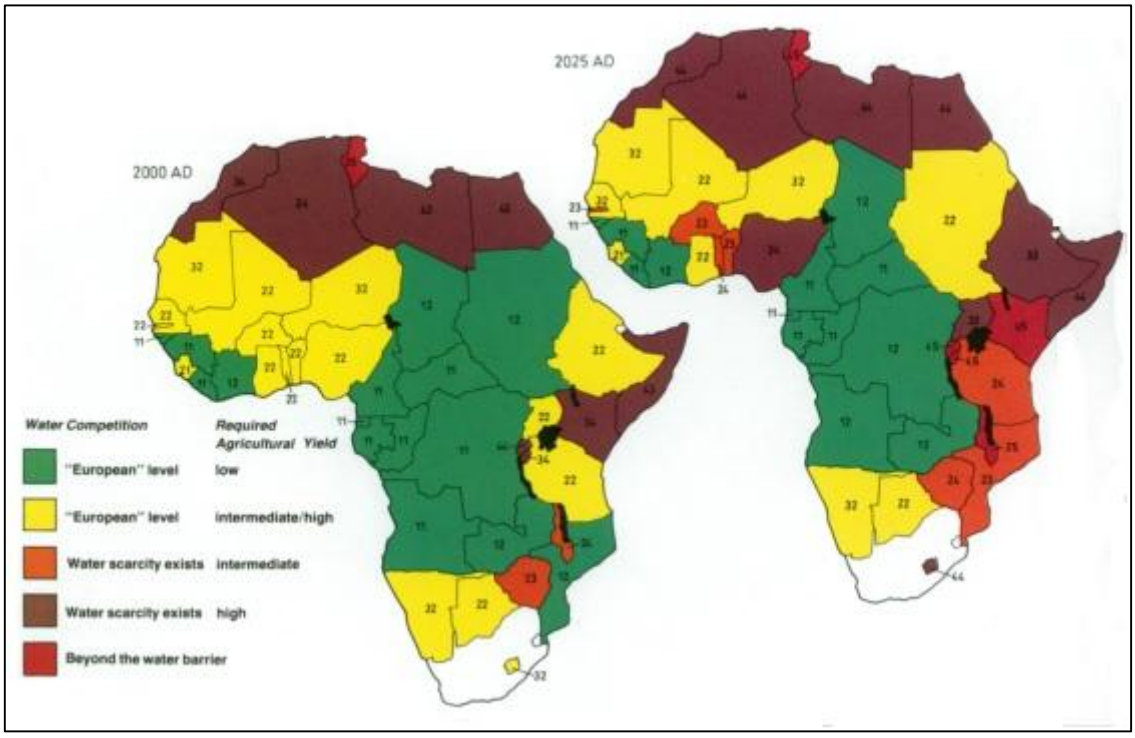
stress indicator with 1 referring to water abundance rising until reaching absolute/extreme water scarcity at 5.

Code´s tens place	Water security condition	Code´s ones place	Water stress condition
1	Low level enough	1	Water abundance (European level)
2	Intermediate level enough	2	Intermediate level but no water stress (European level)
3	High level enough	3	water stress
4	High level not enough	4	water scarcity
		5	Absolute water scarcity

Table 1-2: Water stress index of Falkenmark (1989).

The study results show that the number of states that suffer from water stress is expected to increase from 11 countries in 2000 to 21 countries in 2025. These 21 countries will have a population of 1100 million people, representing two-thirds of the population of the continent in 2025 (Map 1-2). Another interesting finding of this well-known study is that those three regions in Africa will suffer more for the double challenge of water scarcity and the need for increasing agricultural production to meet the increasing population growth. The group that is expected to suffer most is the North African countries. All the countries of North Africa score 4 or 5 in the water stress index, which means that they will be suffering from either level of water scarcity, with Tunisia in the absolute water scarcity. Moreover, all of them score between 3 and 4 in the water security index, which indicates that they will need huge scale irrigation-based agriculture or even have to import food to meet the population's needs. The second group that will face the burden of water security by the year 2025 is the eastern and southern group. All of the countries these group, with the exception of Sudan, will be water stressed or worse. Six countries will be facing water scarcity and four (Kenya, Rwanda, Burundi and Malawi) will be in absolute water scarcity. Moreover, five countries of this group score 4 in the water security index, which means that these countries will be in need of high irrigation-based agricultural yields or even have to import food for self-sufficiency. Finally, five

of the West African countries will become at least water stressed by the year 2025. However, intermediate levels of agricultural yields will be enough, with the exception of Nigeria which has to resort to large-scale irrigation agriculture to reach self-sufficiency by 2025 (Falkenmark, 1989).

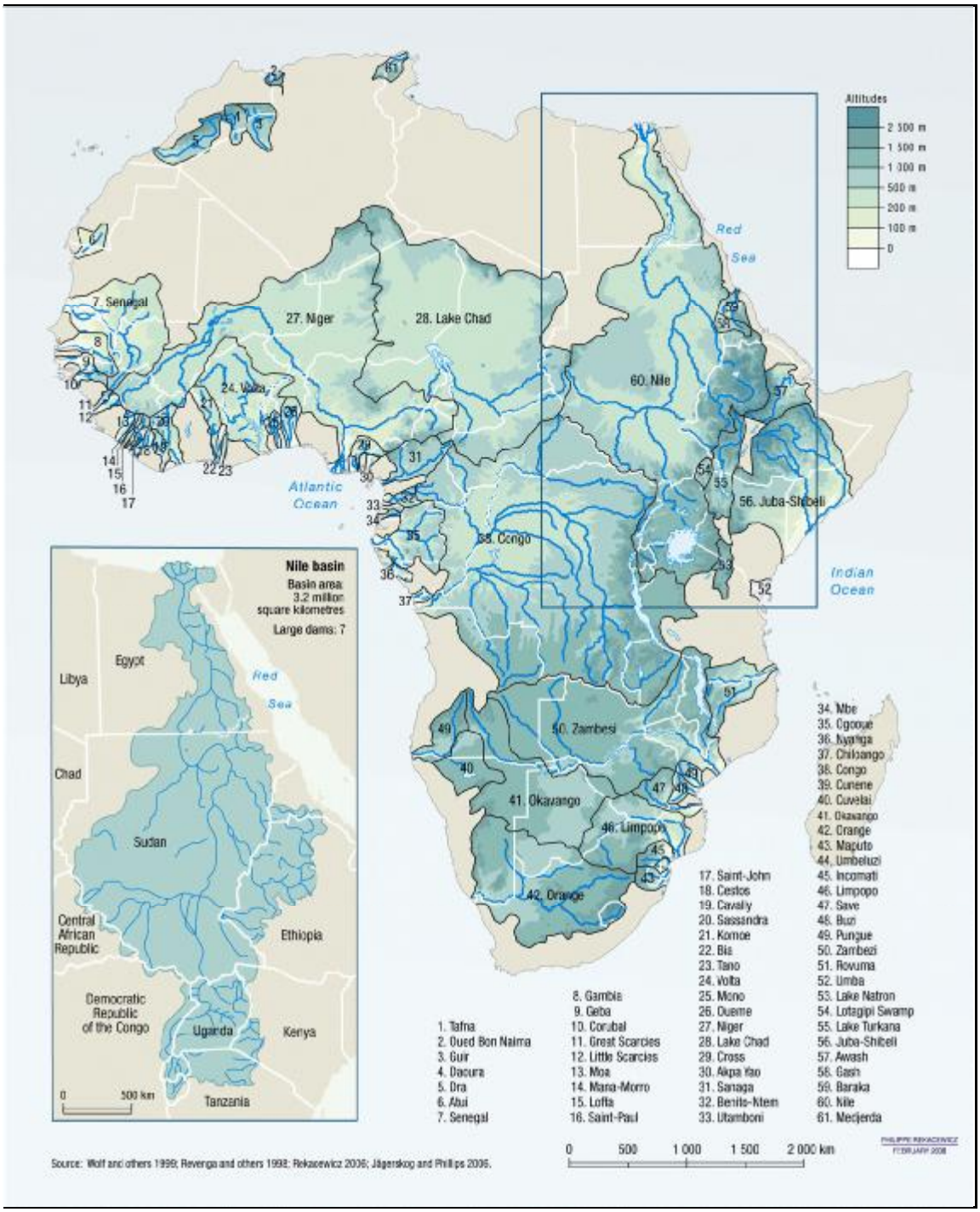


Map 1-2: Water scarcity and food security in Africa in 2025 (Falkenmark, 1989)

2.2.2 Water Interdependence in Africa

Africa is characterised by a deep hydrological independence among its countries. This hydrological interdependence results from the colonial history of the continent (UNDP, 2006). The borders of African countries were delineated by the then colonial powers at the beginning of the twentieth century ignoring the borders and demographic and geographic realities of the continent. Therefore, Africa today has 61 transboundary river basins, as shown in Map 1-3 (UNDP, 2006). These transboundary basins cover 61% of the total land area of the continent, host 71% of the African population and include 93% of all surface water in Africa (Jägerskog & Phillips, 2006).

Moreover, the variability of the climate over the continent has resulted in enormous disparities in water resources availability within the same regions (Turton, et al., 2006). In many of the large African transboundary rivers, the majority of the water comes from the well-watered regions to the dry regions of their basin. Therefore, these drier downstream regions are dependent on this water coming from upstream riparian countries (Turton, et al., 2006). This unbalanced pattern of water distribution has intensified the degree of water interdependence and raises the possibility of conflicts over water resources.



Map 1-3: Transboundary river basins in Africa (Rekacewicz, 2007)

2.3 Nile Basin

No region demonstrates the severity of the water management challenge better than the Nile Basin. This severity comes from the fact that the region is not only facing a transboundary water scarcity problem, but also experiencing an extremely difficult developmental challenge.

A closer look at the water problem in the Nile Basin region (Map 1-3) reveals that the region suffers from both water scarcity and unbalanced transboundary water interdependence. With regard to water scarcity, all the Nile riparian countries are located in North and East Africa, which are the two regions that are expected to suffer most from water scarcity, as explained above. As the abovementioned IWMI study (2007) indicated that Egypt is already suffering from physical water scarcity while the rest of the Nile riparian countries suffer from economic water scarcity. Egypt has already passed its water barrier as it withdraws annually 117% of its total renewable water resources (UNDP, 2006). More specifically, the water stress indicator indicates that Burundi, Rwanda and Kenya are expected to move to absolute water scarcity by the year 2025 while Ethiopia and Uganda will join Egypt in the water scarcity category. Moreover, Tanzania will start by this time to suffer from water stress (Falkenmark, 1989). On the hand, the Nile Basin is characterised by a complicated and unbalanced hydrological interdependence. Not only is the Nile Basin shared by a relatively large number of countries, eleven countries, which has created a problem of water management. The problem is exacerbated by the incidence of climate variability among the different regions (Mohamed & Loulseged, 2008). The equatorial regions enjoy abundant rainfall, but rainfall volumes decrease the further we move north from the equator (Turton, et al., 2006). At the same time, rates of evapotranspiration rise as we move north away from the equator. Therefore, the Nile Basin is characterised by enormous temporal and spatial disparities in water resource availability (Turton, et al., 2006). This has resulted in an asymmetrical natural pattern of water use where northern downstream countries are net water users and the upstream countries are net water providers. For example, while Ethiopia provides the river with around 85% of its runoff, Egypt depends

almost entirely on river water which represents 97% of its total renewable water resources (UNDP, 2006).

In addition, the water challenge has been compounded by the developmental challenges faced by Nile riparian countries. These countries suffer from three major challenges: poverty, population growth and climate change. Firstly, the Nile Basin is one of the poorest regions of the world with more than 70% of the population relying on the agriculture sector for livelihood (Mohamed & Loulseged, 2008). Furthermore, the Nile countries are experiencing an expanding population growth. The population of some riparian countries, such as Egypt, is expected to double between 1990 and 2025. Even worse, Kenya's population in 2025 is expected to reach almost five times its 1975 population. Finally, climate change is predicted to cause changes in the timing and amounts of rainfall that exceed the natural variability (Hulme, et al., 2001). For instance, under the moderate climate change scenario rainfall over some parts of equatorial countries is likely to rise by 5% to 20% in the period from December to February and decline by up to 5% in the period from June to August (Hulme, et al., 2001).

This compound water–development challenge has led to expectations of impending water crisis in the Nile Basin. More specifically the divergence in interests between downstream countries and upstream countries is expected to escalate during the next few decades. Since Egypt and Ethiopia are the two countries that are expected to be water-constrained, the expectation of conflict is always directed to them (Keith, et al., 2013).

3 Potential for Cooperation and Conflict

In the light of the above, water has become one of the greatest global problems that has ever challenged humanity. Over the last three decades, there has been an intensive debate about the future of the water relations among riparian states. Water can be a source of cooperation and regional development among riparian states, however, water challenges eventually could lead to the outbreak and spread of water wars in various regions in the world.

Those who argue that water will act as a source for cooperation base their argument on the rare historical incidence of water wars through the history of humanity. According to this view, the record of cooperation over transboundary water resources overwhelms the record of acute conflict and this fact can act as predictor of a similar future trend (Wolf, et al., 2003). In this vein, it has been stressed that the only recorded case of a water war was between two Mesopotamian city-states in southern Iraq 4,500 years ago (Wolf, et al., 2003). Conversely, between the years 805 and 1984 CE, 3,600 water-related agreements were signed between riparian states (Wolf, et al., 2003). Moreover, there have been only 37 incidents of acute conflict over water since 1948, while during the same period, around 295 transboundary water agreements were reached between riparian countries (UN-Water, 2008). Hence this historic evidence of cooperation between riparian states is used to claim that this cooperative and peaceful trend will continue in the future.

The opposing view that there is a high potential for water conflicts in the future is supported by three arguments. First, in the light of the importance and non-substitutability of water, water scarcity is more likely to create intense internal political pressures that constrain the long-term rational options of cooperation (Wolf, 1998). Moreover, the international legal system has been elusive and contains some contradictory legal principles which, when combined with the asymmetrical hydro-political relations between countries, can catalyse conflict between riparian states, especially between upstream and downstream countries (Scheumann & Neubert, 2006). Finally, the growing water challenge coincides with another evolving challenge – climate change – that intensifies its negative impacts (Keith, et al., 2013). This threefold argument has led various researchers and politicians to believe that water will fuel military conflicts in the next decades.

Although the optimistic view has strong historical evidence, one important thing that should be emphasised is that there is no guarantee that the cooperative historical trend will last in such escalating global pressures. The increasing water scarcity and the new phenomenon of climate change are increasingly pressing on human development. One more source of worry is that the water problem is dominated by the perception of developed countries characterised by temperate

climate and relative abundance of water (Falkenmark, 1990). Therefore, the efforts to strengthen the international legal system have been moderate. As a result, most of the developing countries are not only condemned by their water scarcity and interdependence conditions but also suffer from their marginalised position in the international arena. This fact increases the risk of water conflicts in developing countries. Clearly, Africa tops the list of regions at risk of such water wars as a result of the combinations of water scarcity and hydrological interdependence as well as the political instability that prevails in many African states.

In the context of the Nile Basin, the early attempts at water-related cooperation among the Nile riparian countries during the study period can be divided into three phases. The first phase is the colonial phase that extended from the beginning of the twentieth century until the early 1950s. During this period, almost all the riparian countries were colonised except Ethiopia which was an Italian colony for a brief period from 1935 to 1941. Therefore, the water-cooperation initiatives were driven by the interests of the Western colonisers of the riparian countries. These dominant colonising powers succeeded in establishing an institutional framework to organise Nile water that served their economic interests. The subsequent phase covers almost all the second half of the twentieth century. This phase first witnessed a gradual decolonisation of the riparian countries during 1950s. However, the national riparian governments could not make substantial changes in the existing institutional context. Alternatively, the riparian governments resorted to unilateral actions or at best to bilateral initiatives to manage their Nile water resources. By the end of the 1990s, the riparian governments started a new initiative to establish a regional framework for cooperation among the Nile Basin countries. This initiative is known as the Nile Basin Initiative (NBI). Its main objective was to create gradually a legal framework of cooperation among these countries and a coordinating body that would manage and supervise the implementation of this framework. However, this initiative went into a halt by the failure of the countries to reach a consensus on the final draft of this framework. Moreover, by the unilateral declaration of Ethiopia that it was building a new dam on the Nile, the relations among Nile countries have been transformed from a

cooperation pattern into a pattern of conflict. With regard to the Nile Basin, a recent model-based study predicted a system breaking point and an eminent military conflict as a result of water scarcity between Egypt and Ethiopia between 2020 and 2040 (Keith, et al., 2013).

4 Motivations for the Study

It has been shown that the management of fresh water for the world´s billions of inhabitants is expected to be one of the most alarming challenges in the next decades. Furthermore, it is expected the Egypt, my home country, is at risk of falling into a violent conflict in case of failure to reach a cooperative solution with the other riparian countries for the Nile water management during the next few years. Therefore, there is an urgent need to study the challenges that face the Nile Basin riparian countries in order to identify the available opportunities to reach the feasible cooperative water management options.

Various researchers have studied various river basins, including the Nile Basin, from various perspectives. These perspectives include irrigation hydrology, irrigation sociology, rural sociology, human ecology, history, political science, legal studies and economics. As a result, a vast number of specialised studies have accumulated but without a comprehensive analysis of existing policy problems. Therefore, there is a need to resort to a comprehensive approach that can link these different perspectives in a coherent analysis of particular policy problems (Ostrom, 1990).

The idea of this research is to apply the institutional approach to understand how institutions help, or hinder, the cooperation among beneficiaries of the river basin and how institutional change can promote cooperation among them. In general, institutional arrangements of a particular group are the rules of the game that regulate the interactions in this group (North, 1990). The institutional arrangements are classified into formal and informal institutions (North, 2008). Formal institutions refer to the written rules governing polity and economy whereas informal institutions refer to the unwritten conventions and codes that constrain

human interactions (Ménard & Shirley, 2008). Nearly 10 years ago, Oregon State University in cooperation with United Nations Environmental Programme (UNEP) conducted a three-year study to analyse all the potential determinants of cooperation and conflict among riparian countries in river basin. This study has suggested that institutional arrangements are key determinants of the success or failure of cooperation efforts by the riparian countries (Wolf, 2006). In general, the institutional approach stresses that any type of socio-economic development, including common-resource management, can take place only when appropriate institutional support is available (Jägerskog & Phillips, 2006). The existence of binding legal agreements and the possession of the needed institutional capacity effectively to enforce them have a direct positive impact on the capacity of riparian countries in a basin to manage their common water resource (Turton, et al., 2006). On the contrary, the risks of conflict among beneficiaries arise in situations where the available institutional arrangements to govern water scarcity are weak or not conducive to cooperation (Jägerskog & Phillips, 2006). The objective of the study is identify the institutional factors that hinder the cooperation attempts between the Nile Basin riparian countries and identify the necessary conditions for the success of such future attempts to develop a cooperative Nile water management system. The main hypothesis of the research is that feasible economic cooperative solutions have been available to Nile Basin countries, but the history of the relations between the riparian countries has developed a regional context prohibitive to cooperation among them.

CHAPTER 2

REVIEW OF THE RELEVANT LITERATURE AND DEBATE

This section critically reviews the influential conventional economic models that address the problem of common-pool resources. It begins by exploring the dimension of the common resources problem through the Garrets Hardin Model of "the tragedy of commons" (Hardin, 1968). Subsequently, it resumes the basic analytical models offered by conventional resource economics relying on the framework of externalities and market failures. Finally, it examines the strategic interaction models offered by game theory.

1 Natural Resources Economics: Neo-Classical Perspective

1.1 Behavioural Conception

The behavioural conception of neo-classical economics has three main assumptions: the scarcity of resources, utility-based motivation and the capacity of rational choice. Neo-classical economics is concerned mainly with the study of the allocation of scarce resources among competing uses (Hackett, 2006). "Resources can be defined as anything that is directly or indirectly capable of satisfying human want" (Hussen, 2000, p. 3). However, not all the elements can be considered resources. Resources are only those elements that satisfy two basic conditions: firstly, there exist knowledge and technology that enable its extraction and use; and secondly, there is a demand for the produced material or services (Rees, 1990). Scarcity means that, at any point of time, the available resources are not enough to provide for all that people want to have (Hackett, 2006). This scarcity of resources has four consequences: choice, opportunity cost, efficiency and organisational mechanisms (Hussen, 2000). Firstly, scarcity of resources entails competition over them and hence actors in an economy need to evaluate their available options and make choices that serve their interests (Tietenberg & Lewis, 2012). Secondly, choices made by actors have a cost equal to the highest-value alternative sacrificed

(Hussen, 2000). Thirdly, efficiency entails allocating resources to their highest-valued use (Hackett, 2006). Finally, the market system is the organisational mechanism that can efficiently allocate and distribute resources among actors (Hussen, 2000).

The judgment of what constitutes an efficient resource allocation depends on the value system adopted in the economic analysis. Much of the neo-classical economic perspective relies on utilitarianism as its normative standard (Hackett, 2006). Utility is defined as "that principle which approves or disapproves of every action whatsoever, according to the tendency it appears to have to augment or diminish the happiness of the party whose interest is in question" (Bentham, 1781, p. 14). "Utility, or the Greatest Happiness Principle, holds that actions are right in proportion as they tend to promote happiness, wrong as they tend to produce the reverse of happiness" (Mill, 1871, p. 6). Moreover, under utilitarian moral principles, the morality of the actions is irrelevant to its motive but it is determined only by its consequences (Mill, 1871). Jevons (1888) has argued that all pleasures and pains can be represented by positive and negative algebraic quantities that represent utility and disutility, respectively. "The algebraic sum of a series of pleasures and pains will be obtained by adding the pleasures together and the pains together, and then striking the balance by subtracting the smaller amount from the greater. Our object will always be to maximise the resulting sum in the direction of pleasure." (Jevons, 1888, p. 32). Recognising the difficulty of measuring feelings, Jevons emphasised the need to estimate the physical objects that induce such feelings. Therefore, he introduced the term "commodity" as an indicator of actors' feelings. He defined commodity as "any object, substance, action, or service, which can afford pleasure or ward off pain" (Jevons, 1888, p. 38). Consequently, he defined utility as "the abstract quality whereby an object serves our purposes" (Jevons, 1888, p. 38). Finally, he concluded by arguing that any commodity that can induce pleasure or prevent pain has a utility (Jevons, 1888). The sum utility of a commodity is sum of its positive utilities with negative dis-utilities to the actor. Moreover, social utility can be assessed by evaluating the sum total of individual utilities of all members of the society (Hackett, 2006).

Although the concept of rationality is a fundamental assumption of neo-classical economic theory, there have various approaches to the notion of rationality. One common feature of these approaches is its instrumental conception of rationality (Sugden, 1991). An actor shows instrumentally rational behaviour when he adopts, or intends to adopt, suitable means to achieve his ends (Brunero, 2012). Like the utility concept, the economic concept of rational choice has roots in nineteenth-century utilitarian philosophers who concentrated on the motives of such actions. Later, the rationality concept was developed by early economists to focus more on the choices it produces (Simon, 1986).

These early philosophical writings focused on the motives or the "ends" of actions that can be considered instrumentally rational. According to this concept of instrumental rationality, actions can be motivated by rational reflections or only desires by desires. David Hume put more emphasis on desires in forming the motives of rational actions. Although he recognised the role of "reason" on forming desires, he argued that such reflection is shaped by "passion" (Hume, 1739). Hume's argument is twofold: "first, that reason alone can never be a motive to any action of the will; and secondly, that it can never oppose passion in the direction of the will" (Hume, 1739, p. 302).

The classical and neo-classical traditions have reduced Hume's ideas of a desire-based rational choice to a single dimension of self-interest. Adam Smith was the first to put forward, implicitly, self-interest as the motive of actions of individuals in his analysis of the behaviour of agents under competition (Vriend, 1996). In this regard, Smith stated that, "It is not from the benevolence of the butcher, the brewer, or the baker, that we expect our dinner, but from their regard to their own interest" (Smith, 1776, pp. 26-27). Smith (1776, p. 27) stressed that agents are not motivated by humanity but by "self-love". Self-interest motivation was brought explicitly to the central attention of economists by Francis Edgeworth who emphasised that "the first principle of Economics is that every agent is actuated only by self-interest" (Edgeworth, 1881, p. 16). Moreover, Edgeworth prepared the ground for the introduction of the concept of preferences when he expressed the pleasure-based motivation in terms of "preferable feeling" (Edgeworth, 1881, p. 56; Vriend, 1996).

Over time this has given rise to the introduction of concept of "homo oeconomicus" to describe individual economic agents. "Homo oeconomicus is an agent with given preferences, pursuing his self-interest, seeking to do the best he can, given his opportunities" (Vriend, 1996, p. 265). According to this rationality concept, the choices of an agent are determined by his choice criterion, i.e. preferences, and the opportunities available to him (Debreu, 1959; Vriend, 1996). This rationality assumption was reinterpreted for consumer choice as the maximisation of utility from a set of commodities under a budget constraint (Arrow, 1986). Implicitly, this hypothesis of rationality assumes that an agent has unlimited capacity to perceive and understand his/her environment as it exists in the real world and that he/she has unlimited computational powers (Simon, 1986).

1.2 Efficiency and Market Equilibrium

The explanation of the market equilibrium theory is beyond the scope of this research. Therefore, a brief review is provided here. Assuming rationality of economic agents, the market has to meet four conditions to be regarded as an efficient organisational mechanism for efficiently allocating resources: *perfect information* regarding market transactions is available for all economic agents; the number of sellers and buyers is large enough to allow *perfect competition*; *full mobility of resources* among the different sectors of the economy are possible; and finally, *ownership rights* over resources, goods, and service are clearly defined (Hussen, 2000). Neo-classical economists recognised that the utility obtained from additional units of a product declines and hence purchasers' willingness to pay for this product decrease (Hussen, 2000). This law of diminishing marginal utility has led to modelling market demand as negatively sloped curve (Rubinstein, 2006). On the contrary, the market supply curve is modelled by a positively sloped curve for several reasons, including resource scarcity in the long run (Rubinstein, 2006). The market reaches equilibrium when the quantity demanded equals the quantity supplied (Mankiw, 2011). Neo-classical theory has shown that, in this perfectly competitive market, no producer can be better off without at least one buyer being worse off (Burkett, 2006). In other words, the sum total of the net benefit of

producers and consumers is maximised (Burkett, 2006). This conclusion implies economic efficiency at equilibrium, which has been referred to as Pareto optimality (Burkett, 2006). Moreover, equilibrium price is very crucial. From consumers' perspective, it reflects the willingness of purchasers to pay for the last unit of equilibrium output, or the marginal private benefit (MPB) (Hussen, 2000). From producers' point of view, it is a measure of the minimum price they can accept in selling their last unit of equilibrium output, which equals their marginal private cost (MPC) under perfect competition (Hussen, 2000). Moreover, in an ideal market where ownership rights are clearly defined, the long-run equilibrium price measures both the marginal social benefit (MSB) and the marginal social cost (MSC) (Hussen, 2000). Therefore

At equilibrium

$$P_e = MPB = MPC = MSB = MSC$$

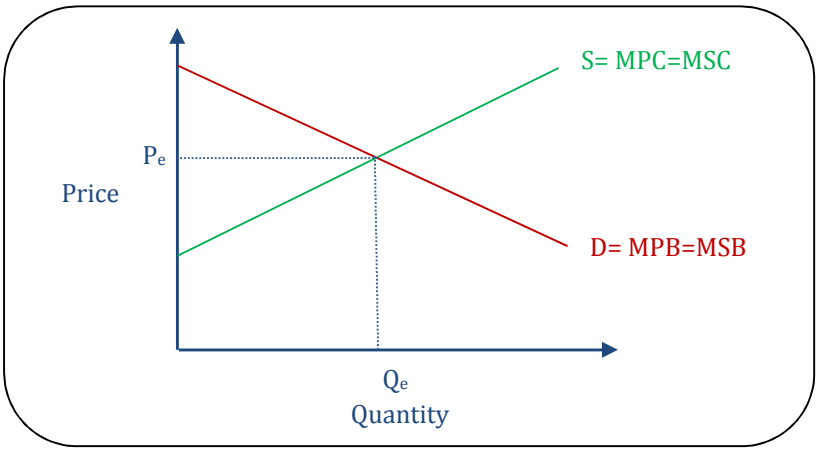


Diagram 2-1: Market Equilibrium

1.3 Environmental Externalities and Market Failure

Resources are usually classified into three broad categories: labour, capital and natural resources. Natural resources, which are the focus of this study, are the stock of the elements of the physical environment that have a potential use for economic agents (Hussen, 2000). Moreover, natural resources are classified into

non-renewable and renewable resources. A resource is considered renewable when it shows a significant rate of growth or renewal in a time interval for which planning and management are significant (Conrad, 1999). "As long as the number of resource units appropriated does not exceed the regeneration rate, the resource stock will not be exhausted" (Ostrom, et al., 1994, p. 8). This research focuses on a specific type of renewable natural resources, which are common-pool resources. Common-pool resources are those shared resources which are commonly managed with entitlements defined either by tradition or by formal rules (Tietenberg & Lewis, 2012). A common-pool resource is characterised by two features: non-exclusivity and rivalry. Non-exclusivity implies the difficulty of excluding an actor from appropriating from the resource stock (Hackett, 2006). Rivalry, or divisibility, means that the appropriation of resource units by one actor subtracts it from those available to the other actors (Tietenberg & Lewis, 2012). Two lines of analyses of the problem of common-pool resources have been provided by Pigou and Gordon.

In general, the term externality is used to refer to a cost incurred or a benefit accrued to a party who does not commit an action that results in that cost or benefit (Buchanan & Stubblebine, 1962). More specifically, externality is defined in terms of the impact on a firm's production, or on an individual's utility, by the activity of other actors (Mishan, 1971). In terms of production, externality refers to a situation in which a firm's production function is influenced, directly or indirectly, by the amounts of the inputs or outputs of another firm (Graaff, I957). In terms of utility, externality is present when the utility of an affected individual is influenced by a vector of activities under his or her own control but also affected by one or more activities under the control of another party, or parties, who belong to the same social group (Buchanan & Stubblebine, 1962; Randall, 1983).

The analysis of Arthur Pigou (1920) of the divergence between private and social net product can be considered the main building block of the analysis of the conditions that give rise to the presence of an externality. Positive externality results from a divergence between private and social benefit whereas negative externality is a result of divergence between private and social cost. Diagram 2-2 shows a negative externality, which is what prevails in common pool resources, in which

marginal social cost diverges upward from the marginal private cost. In this case, the market fails to allocate resources efficiently because the marginal social cost (MSC) is higher than the marginal private cost (MPC). In other words, the market fails to reach Pareto optimality. Pigou (1920) never used the concept of externality in his analysis but his analysis served two purposes: firstly, it showed the impact of the divergence between social and private benefits or costs on the efficiency of the market; secondly, it proposed two policy options to deal with such a situation. The first, favoured by economists, is to impose a tax on producers' output to internalise external costs in their private costs (Pigou, 1920). This tax (t) is commonly named after him as Pigouvian tax and has been agreed by various economists to be equal to the difference between social and private marginal cost for each unit of output (MEC) as shown in Diagram 2-2 (Mishan, 1971). This tax will internalise the external costs in the private costs and will limit the output to the socially optimal quantity (Mishan, 1971). The second option, though not very popular among economists, is to introduce a price ceiling or controls to deprive producers from accruing abnormal profits (Pigou, 1920).

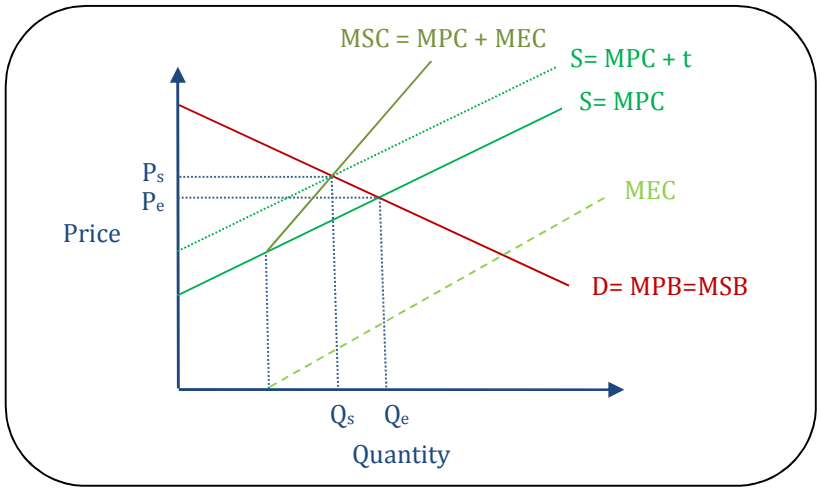


Diagram 2-2: Externality and Pigouvian tax

1.4 Common-Pool Resources

Gordon (1954) analysed the case of fisheries as a representative model for common-pool resources to show the problems that result from appropriation

externalities. In the beginning of his model, he defines the optimum degree of utilisation of any common-pool resource as that "which maximises the net economic yield, the difference between total cost, on the one hand, and the total receipts (or total value production), on the other" (Gordon, 1954, p. 129). Consequently, he indicates that the total production and the total cost can be represented as functions of "the degree of fishing intensity", which is referred to in the model as "fishing effort" (Gordon, 1954, p. 129). As a result, the problem of his model becomes that of finding the optimal amount of fishing effort input and not the optimal quantity of fish output. Consequently, he assumes, substantively, that the production function, which relates the output to the fishing efforts, is subject to the law of diminishing returns. Moreover, for simplicity, he assumes that the market price of the fish is not affected by the amount of fishing efforts and therefore the average effort cost (AC) and the marginal effort cost (MC) are constant and identical.

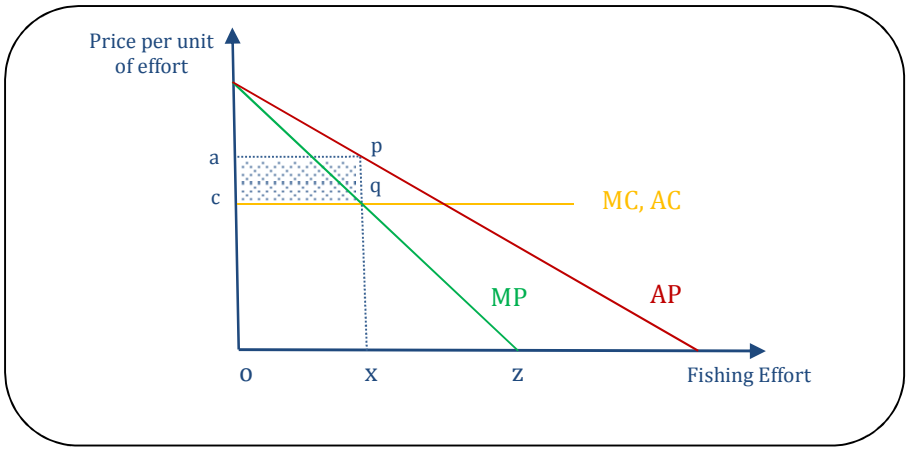


Diagram 2-3: Common-pool resource (Gordon, 1954)

As shown in Diagram 2-3, the economic optimum intensity of effort on this fishing ground is the amount represented by the distance (*ox*). The resource at this level of appropriation provides the maximum net economic yield represented by the shaded rectangle (*acqp*). However, the maximum sustainable physical yield is achieved at the point z where the marginal productivity of fishing effort is zero and fishing effort is (*oz*). However, at such physically sustainable level, the rents to appropriators are lower than that of economically optimum level. Clearly, the model shows that the optimum economic fishing intensity is lower than what would produce the maximum sustainable physical yield. Therefore, Gordon argued that

such open-access common resources give rise to a pattern of competition among appropriators that leads to the dissipation of economic rent. Hardin (1968) developed this idea by showing that open-access common resources are not only economically inefficient but also physically inefficient and unsustainable. Hardin was the first to coin the term "tragedy of commons", clarifying that in this tragedy "each man is locked into a system that compels him to increase his herd without limit – in a world that is limited. Ruin is the destination toward which all men rush, each pursuing his own best interest in a society believes in the freedom in the commons." (Hardin, 1968, p. 1244). This assertion goes in line with the conclusion of Gordon that "there appears, then, to be some truth in the conservative dictum that everybody's property is no body's property" (Gordon, 1954, p. 135).

Inspired by the analysis and the conclusion of Gordon, property rights theorists have focused on establishing an adequate structure of property rights that can support an efficient allocation of shared resources. Property rights can be defined as the rights of an actor to utilise valuable resources (Alchian & Demsetz, 1973). The function of the market is efficient allocation of rights among actors (Alchian, 1967). These rights can be considered as social instruments that help actors to form their expectations about what they can hold in their exchanges with others (Demsetz, 1967). Therefore, efficiency can be achieved if the value of any resource units or goods exchanged in the market reflects the bundle of property rights that is transferred in this transaction (Furubotn & Pejovich, 1972). Therefore, as noted above, one of the main conditions for the market to allocate resources efficiently is having a clear definition of ownership rights. Efficiency can be achieved only if the structure of property rights is non-attenuated (Demsetz, 1964). A non-attenuated structure of rights has the following characteristics: firstly, the set of rights is completely specified; secondly, rights must be exclusively specified; thirdly, rights are economically enforceable and enforced; and finally, rights should be transferable (Randall, 1975). The breakdown of the non-attenuated structure of rights will lead to market inefficiency in allocation of resources, or so-called market failure (Randall, 1975). Therefore, the entitlements of resource appropriation should be regulated by a non-attenuated structure of property rights to avoid the

damage resulting from externalities. This approach was emphasised by Coase (1960) in his well-known theorem. According to this theorem, given a well-defined structure of property rights, a costless transferable and enforced exchange will eliminate all externalities and the resource allocation will not be determined by the pattern of the assignment of property rights (Coase, 1960). This means that the initial pattern of property right assignment will not have any impact on the efficient level of appropriation of the common resource. In other words, given the previously noted assumptions, the pattern of the efficient allocation of resources in equilibrium will not only eliminate the externality but also will not be affected by any initial assignment of property rights. However, Coase (1960) himself recognised in the same work his assumption about costless establishment of the property rights structure neglected the costs of the exchange of rights. This led him to devote a considerable space in this work and his following writings to transaction costs. These writings represented the cornerstone of the new institutional economics framework that will be used as the analytical framework of this study. Moreover, analyses of the common-pool resources have shown that the existence of situations in which the conception of utility as seeking self-interest and market efficiency are not compatible. This has given rise to the game theory employed to conquer that space by aiming at finding an efficient solution for common-pool resources.

2 Game Theory

2.1 Behavioural Conception

Another view of rationality started to evolve among economists in the early 1930s. This view was a result of deliberate effort by economists to develop a purer concept of rationality that is free of psychological assumptions (Sugden, 1991). This new understanding also helped later in closing the gap between self-interest motivation and efficiency in the cases of externalities, including the tragedy of commons. The new perspective holds that internal consistency of an agent's choices is a condition for rationality (Vriend, 1996).

Ramsey (1931) argued that consistency stems from the fact that every human mind works according to some general rules. However, he confessed that the human logic that lies behind these rules is influenced by the experiences of individuals (Ramsey, 1931). Moreover, he clarified that experienced frequencies of events occurring often result in beliefs that lead to particular expectation of event occurrence probability corresponding to each choice (Ramsey, 1931). Von Neumann and Morgenstern (1944) developed Ramsey's ideas by integrating the risk factor into the conception of ordinal utility function, which was introduced originally by Daniel Bernoulli in 1738, to map the decision preferences of each individual confronting risky options (Fishburn, 1995). This utility function is formed based on his personal utility and his personal probability distribution of the probable outcomes (von Neumann & Morgenstern, 1944). This utility function, which is known as the subjective expected utility, was used by von Neumann and Morgenstern (1944) to develop their pioneer work in game theory. Savage (1954) provided a more detailed account of this utility concept in which he mapped this human logic by a set of simple axioms that regulate the preferences of a rational agent who aims to maximise his or her expected utility in a situation characterised by uncertainty. It should be noted that this axiom regulates the logic of preference but does not determine it as preferences itself are specific to each person. Each person has his or her own set of reasons and rules that determine his or her choices in different situations (Savage, 1954). Therefore, according to this rationality

conception, two decisions of an individual can be judged as inconsistent, or irrational, only if they cannot be determined by any single set of reasons (Sugden, 1991).

2.2 Basic Concepts

Game theory is described as "interactive decision theory" (Aumann, 2000, p. 47). The foundations of the theory were laid by von Neumann and Morgenstern (1944) as a mathematical approach for studying economic problems. In the following decades, the theory of games has become influential in social sciences such as economics, political science, management and even philosophy (McCain, 2009). Game theory has been used for three main purposes: explaining real and experimental events and outcomes, predicting the evolution and the outcome of already developing situations, and advising or providing recommendations for future interactions (Dixit, et al., 1999). However, it should be emphasised that game theory does not deal with isolated decision situations in which each actor can act without taking into consideration the actions or reactions of the other actors (Dixit, 1996). It focuses only on analysing the strategic interactions between actors (von Neumann & Morgenstern, 1944). Interactions become strategic when the participants of such interactions are mutually aware of the cross-effects of others' actions and the actions taken as a result of such mutual awareness (Dixit, et al., 1999). It is also important to differentiate between games and game theory. Games of strategy refer to strategic interactions or situations whereas game theory is a mathematical analysis of how participants in a strategic interaction will probably act (Camerer, 2003). Equally important to reiterate that game theory has adopted a new classical behavioural conception relying on an adapted conception of rational behaviour and utility maximisation (von Neumann & Morgenstern, 1944). It assumes that players are perfect calculators and make the decisions that promote their own interests most effectively in strategic games (Harsanyi, 1977).

It is imperative to begin with deconstructing the structure of a strategic game to clarify its dynamics and outcome. A game in a strategic form includes three elements: a set of players, a set of strategies available to each player, and a set of

payoffs of each player for all possible strategies (Fudenberg & Tirole, 1991). Each game includes multiple decision makers, two or more, called players (Rosenthal, 2011). Each player has a set of choices available for him in each point of the game. Therefore, the complete plans of action that each player develops to guide his movements in all the stages of the game are called strategies (Dixit, et al., 1999). When all the players choose a particular strategy to follow, the result of the game is called the outcome (Rosenthal, 2011). This outcome is represented in a numerical scale that allows analysts to compare the desirability of the different outcomes of the game. The number attached to each possible outcome is called its payoff (Dixit, et al., 1999). Best strategies are usually decided either by comparing the average payoffs of the available strategies or by choosing the strategy that minimises the player's exposure to negative outcome (Rosenthal, 2011). Moreover, a strategy is considered a dominant strategy "if it is a strict best response to any feasible strategy that others might play" (Camerer, 2003, p. 25). Finally, the outcome is called Nash equilibrium if it has a set of players' strategies such that the strategy of each player is a best response to the strategies of other players (Fudenberg & Tirole, 1991).

Games are classified into a few categories according to the features of their context. Firstly, they are classified into sequential and simultaneous games. In sequential games, the actor who plays later is aware of the earlier actions of the other actor (Dixit, et al., 1999). A game is simultaneous not only when players act simultaneously but also when they act sequentially but the later player acts without knowledge about the action of the earlier player (Dixit, et al., 1999). Secondly, games are also categorised according to the availability of information to players. If all players have all the information related to their options at all points of the game and the other players' options and moves, the game is one of perfect information (Davis, 1973). When players do not have all the information related to their own movements or other players' movements, the game is considered to have imperfect information (Dixit, et al., 1999). Moreover, when one player is better informed about the game context than the other player(s), the game is of asymmetric information (Dixit, et al., 1999). Thirdly, games are also grouped according to the degree of conflict/coincidence of interests of players. In zero-sum games, the interests of the

players are in total conflict and therefore the total benefits that can accrue to players always add to zero, what one actor wins is what the other actor loses (Rosenthal, 2011). When there is a margin for cooperation and mutual benefits between players in a game, this game is considered a nonzero-sum game in which the total gains of the players do not always adds up to zero or a given constant (Rosenthal, 2011). Fourthly, another terminology is used to distinguish between situations in which actors are able to establish binding commitment and those in which they are not. If players can make an enforceable joint-action agreement, the game is considered cooperative (Dixit, et al., 1999). In this case players take into consideration not only their own payoff but also the common payoff of all players (Cerdá, 2011). To the contrary, when players are allowed to act in their own interests the game is called non-cooperative even if cooperation among them emerges as a result of coincidence between their interests (Dixit, et al., 1999). In this case players are motivated only by their own payoff (Cerdá, 2011). Finally, another important game-playing technique is linking a game on a particular area with other games on other issues. When the players get involved in more than one game simultaneously, they can exchange their concessions in one game for another in another game according to their interest and positions in these games (Cerdá, 2011). Such issue linkage can help to solve the problem of the difference in interest among players in a certain game by linking it to other games where they have a balancing difference in interest (Cerdá, 2011).

2.3 Collective-Action Game Models

Common resources problems are analysed as problems of collective actions. Three main collective-action game-theory models are used to analyse the dynamics of common resources: the prisoners' dilemma game, the chicken (or hawk-dove) game and the assurance (or stag-hunt) game. First, these games are presented with simple illustrative problems then detailed common-pool resources problems are analysed using these games.

2.3.1 Prisoners' Dilemma Game

This game analyses the story of two suspects arrested for a crime but without sufficient evidence. The officers separate them in different cells to prevent them from communicating with each other. To give them an incentive to cooperate with the police, officers tell each of them that he will be released and receive a reward if he confesses, provided that the other remains silent. In this case the silent suspect will go to prison. However, if both of them confess, both will be sentenced but they will receive rewards for confessing. If neither of them confesses, both will be released because of the lack of sufficient evidence. The dilemma for each of them is whether to trust the silence of the other or to play it safe by choosing the police reward. This simultaneous game is presented in a matrix or table (normal) form (Table 2-1). Both players choose between two actions: cooperate together (C) or do not cooperate by confessing (Defect-D). If both cooperate by keeping silent, each of them obtains 1. If both do not cooperate by confessing, both get 0. If one cooperates by keeping silent and the other defects by confessing, the betrayer is rewarded (gets 2) and the silent will be punished (gets -1). Although cooperating would give both of them the higher payoff, their strictly dominant strategy is to confess and therefore the outcome of the game is (D, D).

	C	D
C	1,1	-1,2
D	2,-1	0,0

Table 2-1: Prisoners' dilemma (Fudenberg & Tirole, 1991).

This prisoners' dilemma model is used for analysing some patterns of common resources problems, such as groundwater systems and irrigation projects (Medani, 2010). For example, if two farmers need to build an irrigation project, the payoff for each of them is his net benefit, which is his crop revenue minus his share of the project cost (Table 2-2). Therefore, if both farmers cooperate in sharing the project cost, they both get 1. If one of them defects by abstaining from building the

project while free riding it but the other assumes the total cost of the project, the latter gets -1 because his net benefits will decline and the first gets 2. If both defect both will maintain the status quo and get 0. Similarly, the Nash equilibrium of this game is (D, D). The problem of such a collective action situation that the individual's optimal choice (each player's dominant strategy is not to build) does not lead to the socially optimal outcome, which is building the project (Dixit, et al., 1999). In other words, although this outcome is Nash equilibrium, it is inferior to the Pareto-optimal equilibrium (C, C). The game in general form can be characterised by the payoff parameters satisfying the following conditions:

Condition 1: a > d Condition 2: c > a Condition 3: d > b

	C	D
C	a , a	b , c
D	c , b	d , d

Table 2-2: Irrigation project as a prisoners' dilemma (Ostrom, et al., 1994).

2.3.2 Chicken Game

One version of the situation that the chicken game analyses is where two drivers, heading towards each other, meet at a one-lane bridge (Fudenberg & Tirole, 1991). If one of them plays weak (W) by swerving (chickens out) and the other plays tough (T) by choosing to cross, the first gets 0 as he avoided the crash at the expense of his reputation whereas the later will get 2 for crossing the bridge bravely. If both play tough (T) by deciding to cross at the same time, they will collide and get (-1) for the damage and the failure to cross the bridge. If both chicken out and play weak by waiting for the other to cross, both get (1) for failing to cross the bridge but as both of them chicken out, neither of them can criticise the weakness of the other (Table 2-3).

	W	T
W	1,1	0,2
T	2,0	-1,-1

Table 2-3: Chicken game.

By changing the hypothetical irrigation project somewhat, it could be analysed as a chicken game (Table 2-4). Suppose that, for any two farmers, the option of building the project if the neighbour defects is still better than the status quo. In this case, if both farmers play tough by rejecting the project and maintaining the status quo both get (-1). If one of them plays tough (T) by shirking and the other builds the project himself, the first will obtain (2) by free-riding the benefits of the project and the first gets (0) as the cost of the project will be deducted from his benefits. Finally, if both played weak by participating in building the project both get (1). In this game there is no strictly dominant strategy, the best response for each of the two farmers is to free ride when the other builds. There are two Nash equilibria at (W, T) and (T, W) but both of them are inferior to the social optimal outcome (W, W). The game in general form can be characterised by the payoff parameters satisfying the following conditions:

Condition 1: $a > d$ Condition 2: $c > a$ Condition 3: $d > b$

	W	T
W	a , a	b , c
T	c , b	d , d

Table 2-4: Irrigation project as a chicken game (Ostrom, et al., 1994).

2.3.3 Assurance Game

The version presented here is deals with a case of two hunters where each one of them has to choose whether to go with the other to hunt a stag or hunt hare

by himself (Fudenberg & Tirole, 1991). If one of them chooses to hunt hare he gets a payoff (1) if the other goes for stag and (0) if the other also goes for hare as the competition over hares increase. If both go together to hunt a stag, both get (2) as their chances of catching it become higher. If one player chooses to hunt a stag but the other choice turns to be a hare, he gets (-1) as his capability to hunt a stag diminishes. In this model, it is better for each of the players to go for a stag once he is assured that the other will go too. In this game, we have two equilibria (S, S) and (H, H), but only the first of them is a socially optimal equilibrium (Table 2-5).

	S	H
S	2,2	-1, 1
H	1,-1	0,0

Table 2-5: Assurance game.

The irrigation project can be transformed to an assurance game by reducing the benefit of the project in the case of it being built by only one of the two players (Dixit, et al., 1999). The worst choice for either of the two farmers then is to assume all the costs of the project while the other free rides it. Therefore his best option is to assure that the other will cooperate before building the project. Otherwise, he will abstain from building the project. There are also two Nash equilibria at (S, S) and (H H) but both of them are inferior to the socially optimal outcome (S, S) (Table 2-6). The game in general form can be characterised by the payoff parameters satisfying the following conditions:

Condition 1: a > d Condition 2: a > c Condition 3: d > b

	W	T
W	a , a	b , c
T	c , b	d , d

Table 2-6: Irrigation project as an assurance game (Ostrom, et al., 1994).

2.4 Critical Assessment

Game theory provides a dynamic framework for analysing strategic situations. Therefore it has two main advantages over conventional economic methods. First, it has the capacity to analyse multi-criteria multi-decision maker problems (Medani, 2010). In game models, each player optimises his objective while remaining aware that others' decisions affect his payoff and that his decisions affect others' payoff. On the contrary, conventional optimisation methods usually reduce economic actors into a single decision maker with a composite objective, such as social welfare function, then attempt to optimise such composite objective. The weakness of the conventional technique is that it assumes perfect cooperation among the actors, which is an assumption that is far from being realistic. Second, the framework has strong tools and broad concepts that are capable of analysing not only individuals' action but also state and organisational actors (Axelrod, 1984). Actions are not necessarily performed by a unified actor, they might be the outcome of complex bureaucratic procedures or complicated tactics and changing political coalitions (Allison & Zelikow, 1971).

However, strong criticism has been levelled at the rationality assumption adopted by the theory. Firstly, simple examination of social agents' behaviour reveals that, even in relatively simple decision problems, most actors do not always act rationally in the sense that they examine all the choices available and consciously choose the one that maximises their return. Secondly, self-interest maximisation is often quite difficult; most individuals and even specialists cannot conduct them in reality (Simon, 1955). Thirdly, "polls and laboratory experiments indicate that people often fail to conform to some of the basic assumptions of rational decision theory" (Aumann, 1997, p. 2). Fourth, laboratory experiments show that the analyses of games based on rational assumption sometimes fail to conform to the real events and situations (Ostrom, et al., 1994).

CHAPTER 3

CONCEPTUAL FRAMEWORK

The management of fresh water for the world's billions of inhabitants is expected to be one of the most alarming challenges in the next decades (Waterbury, 2002). This has stimulated many researchers to study various river basins from various perspectives. These perspectives include irrigation hydrology, irrigation sociology, rural sociology, human ecology, history, political science, legal studies and economics. As a result, a vast number of specialised studies have accumulated but without a comprehensive analysis of existing policy problems. Therefore, there is an urgent need to apply a comprehensive approach that can link these different perspectives in a coherent analysis of particular policy problems (Ostrom, 1990). The objective of this research is to employ the institutional approach to understand how institutions help, or hinder, the cooperation among beneficiaries of the river basin and how institutional change can promote cooperation among them. Therefore, the research uses two theoretical perspectives: new institutional economics (NIE) and the capability approach (CA). These two perspectives acknowledge the role of norms and beliefs of agents in forming their perceptions and interactions. Moreover, they provide deep analysis of the influence of the social and organisational contexts of policy arrangements on the dynamics of economic interactions and processes.

This section starts by presenting a review of the new institutional economics and the capability approach. An assessment of their strengths and limitations is then provided. Consequently, it concludes by presenting the rationale for combining the capability approach and the new institutional economics in one integrated analytical framework.

1 New Institutional Economics

This section explores the theoretical foundations of the NIE and its models. There are three main theoretical roots for the NIE: human behaviour conception, collective action analysis and transaction costs theory. Moreover, the NIE takes the form of three main models; each of them analyses a particular level of economic activity: international, macro-economic and micro-economic.

1.1 Theoretical Roots

The NIE provides insightful guidelines for identifying the role of the social and economic contexts in shaping the results of public policies. The NIE is built up gradually from three theoretical building blocks. Firstly, the conception of human behaviour that was developed mainly by Herbert Simon (1957) represents the first building block. Secondly, the analysis of collective action by John Commons (1931) introduced the role of institutions in economic exchanges. Finally, the theory of transaction costs introduced by Ronald Coase (1937) represented the cornerstone for the development of the NIE.

1.1.1 The Behavioural Conception of New Institutional Economics

NIE has adopted a behavioural conception developed from an adapted version of the neoclassical behaviour approach. NIE has maintained the neoclassical assumption of scarcity of resources and hence that of competition over them (North, 1997). However, it modified two dimensions of the neoclassical behavioural approach: the capacity of rational choice and utility-based motivation.

NIE has replaced the neo-classical assumption of “rational choice” with the assumption of “bounded rationality” developed by Herbert Simon (1955, p. 114). According to him, “human behaviour is intendedly rational but only boundedly so” (Simon, 1947, p. 88). The rationality of economic agents is constrained by two conditions: the complexity of the environment and goal conflict among agents (Simon, 1972). The environmental complexity results from the fact that market interactions between agents develop in environments dominated by uncertainties

beyond the capacity of the human mind (Simon, 1957). Moreover, goal conflict among agents results because some of them tend to behave opportunistically (Simon, 1979). This possibility of opportunism leads to a situation in which agents have incomplete information about available alternatives which constrain even more the capacity of rational choice of agents (Simon, 1972). This combination of behavioural and environmental constraints on the human capacity for choice is detrimental to the spirit of cooperation in human interactions (Williamson, 2005).

Although NIE has retained self-interest as the predominant motive of human behaviour, it allows space for altruism. Altruism has been explained by two models: the moral force of conventions and dual-interest motivation (North, 1990). The first explanation is provided by Sugden (1986) who demonstrated, using game theory, that if conventions of coordination are widely adopted by a community, then cooperation will have a moral force over its members. Margolis (1982) has provided another explanation by developing a dual-interest motivation model in which he argues that human behaviour is partially determined by group interest because each individual has two utility functions: a self-interest preference function and a group-interest preference function. Each individual makes a trade-off between these functions in his or her decisions according to the weight he or she gives to each of them (Margolis, 1982). It worth mentioning that these two models have not been employed by the NIE in a mutually exclusive way, but each one has been used to explain certain patterns of altruism.

1.1.2 Collective Action Analysis

Commons (1932) was the first to propose transactions to be the units of economic analysis. In his attempt to analyse the human interaction within the constraints of the neo-classical assumption of scarcity of resources, Commons conceived individuals' interactions as relations of conflict, mutuality and order. Therefore, he argued that human actions must be conceived as "*trans*-action instead of either human behaviour or exchange of commodities" (1931, p. 651) (italics in the original). Thus, a transaction is a unit of mutually dependent interests and therefore it should be used as the unit of economic activity (Commons, 1932).

Moreover, Commons argues that these transactions must be studied within the framework of institutions. He defines institutions as "Collective action in control, liberation and expansion of individual action" (Commons, 1931, p. 648). Commons (1931) asserted that institutions can take the form of formal rules of regulations, customs and traditions, or organisations.

1.1.3 Transaction Costs Theory

The transaction costs theory has been developed to analyse the problem of cooperation in economic interactions. Coase (1937) recognised the viability of the transaction as a unit of economic analysis. He explained that the division of labour and specialisation require economic agents to have the ability of transferring their rights over their labour and goods to increase their wealth. Therefore, this exchange of property rights in an economic interaction must be used as the unit of economic analysis (Coase, 1937). A transaction can be conducted in the market using the price as a coordination mechanism or within an organisation using hierarchical coordination mechanisms (Coase, 1937). Coase (1993) emphasised that enterprises come into existence as a necessary mechanism to organise transactions in a hierarchical institutional structure that can economise transaction costs. With regard to market transactions, Coase indicated that price mechanism is not the only cost assumed by agents in a market-mediated transaction as there are other costs of using the price mechanism itself (Coase, 1937). These additional costs result from the behavioural and environmental constraints that bound the rationality of economic agents (Williamson, 1975). These costs are the costs of collection of information, negotiations and enforcement of contracts (Coase, 1960). These transaction costs can be classified into three categories: ex-ante transaction costs; transformation or negotiation costs and ex-post transaction costs (Coase, 1960).

First, ex-ante transaction costs include search costs and information costs. Search costs are the costs of determining the appropriate trading partner in a market (Hobbs, 1997). Information costs differ between buyers and sellers. While it represents for buyers the costs of gaining the necessary information about the quality of products and services of sellers and their profit margins, for sellers it

represents the costs of identifying the needs of buyers and their financial status (Downs & Mui, 1998). Clearly, these search and information collection costs depend mainly on the cost of communicating the information about the existing sellers and buyers and the available offers from both of them (Chowdhury, 2002). Therefore, high communication costs lead to high ex-ante transaction costs that will in turn lead to either a limited transaction or to the absence of a required transaction (Chowdhury, 2002).

Second, transformation costs refer to the costs of physically conducting a transaction. It includes negotiation and decision costs. Negotiation costs are the costs of physically negotiating the terms of exchange, including transport cost, and costs of the formalisation of contracts (Hobbs, 1997). Decision costs for buyers are the costs of evaluating the seller's terms compared with other potential sellers whereas for sellers it represents the costs of evaluating different buyers to decide upon their best buyers (Downs & Mui, 1998). Negotiation costs depend on market structure, dependency of transaction parties on the product and the knowledge of the parties to the transaction about the product (Chowdhury, 2002). Clearly, the dependency of buyers on a small number of sellers, i.e. oligopoly structure, decreases their bargaining power and increases their negotiation costs whereas the negotiation costs of sellers decrease (Chowdhury, 2002). Similarly, the negotiation costs of sellers increase in the case of having an oligopsony market structure whereas the negotiation costs of buyers decrease.

Ex-post transaction costs can be divided into monitoring costs and enforcement costs. Monitoring costs are the costs of ensuring that the terms of the transaction are fulfilled by all parties (Hobbs, 1997). Enforcement costs are the costs of ensuring that unfulfilled terms of transactions are either rectified or compensated (Downs & Mui, 1998). Ex-post transaction costs are determined by the type of contract between transaction parties, payment method and contract enforcement mechanism (Chowdhury, 2002).

1.2 NIE Models

NIE has three main theoretical models that will be employed in this study: the institutional framework, the social institutional change model, and the institutional analysis and development (IAD) framework. While the institutional framework was developed by the individual work of Douglas North and Oliver Williamson, the social institutional change model was introduced by North. Finally, the IAD framework is the result of the work of Elinor Ostrom (1990).

1.2.1 Institutional Framework

The institutional framework is composed of the rules, which structure the interactions among agents (North, 1990). The institutional framework comprises two sub-models: the macro-level institutional environment model and the micro-level governance institutional structure model.

In the institutional environment model, North developed transaction costs theory as a political economy framework, which can be used to analyse not only economic transactions but also social and political interactions. Drawing on the work of Simon and Commons, North (1990) defines institutions as constraints developed by actors to cut down their costs of interactions by reducing uncertainty. However, "institutions are not necessarily or even usually created to be socially efficient; rather they, or at least the formal rules, are created to serve the interests of those with the bargaining power to devise new rules" (North, 1990, p. 16).

The institutional environment of a society comprises formal and informal institutions and their enforcement mechanisms (North, 2008). As previously indicated, formal institutions are the written rules which regulate polity and economy. They comprise political rules, economic regulations, and contractual arrangements (Ménard & Shirley, 2008). Political rules establish the political hierarchical structure from constitutions to different degrees of laws. Economic regulations mainly define property rights and set the rules of their exchange (North, 1990). Contracts include the specific provisions to an agreement (North, 1990).

Informal institutions refers to the unwritten common conventions and codes which underlie the behavioural patterns (Ménard & Shirley, 2008). These informal institutions can be classified into three groups: complementary, normative and cognitive institutions (North, 1990). Complementary informal institutions are extensions, enhancements and adjustments to formal institutions (North, 1990). Normative informal institutions refer to the social values and norms that constrain the behaviour of actors. While values are conceptions of the socially desirable behaviour according to a specific mental structure of standards, norms identify the morally accepted paths to achieve valued goals (Scott, 1995). Cognitive informal institutions are subconsciously accepted standards and beliefs that internally constrain behaviour. Cognitive institutions are taken-for-granted scripts of reality (Di Maggio & Powell, 1991, p. 15) and frames through which meaning is developed (Scott, 1995, p. 40). Although both normative and cognitive institutions are originally socially or organisationally constructed, the main difference between them is the degree of internalisation, which is referred to as institutionalisation. The degree of institutionalisation depends not only on social and organisational contexts but also on the personal characteristics of different individuals (Zucker, 1991). Cognitive institutions are internally imposed standards of conduct that are more persistent to change (North, 1990). Unlike Commons (1931), North differentiates between institutions and organisations. Organisations are "made up of groups of individuals held together by some common objectives" (North, 2008, p. 22). For him, while "institutions are the rules of the game … organisations are the players" (North, 1990, p. 22).

According to North, the institutional environment performs two functions. Firstly, it regulates the interactions of organisational and individual actors and hence constrains their actions (North, 1990). Secondly, it provides the incentive structure available to organisations and individuals and hence defines the available opportunity set for them (North, 1990). Therefore, it guides their choices and investment decisions by dictating the kind of skills knowledge of maximum return (North, 2008). In this later context, transaction costs refers to "an actor´s opportunity cost of establishing and maintaining internal control of resources"

(Eggertsson, 1996, p. 8).

Williamson has enlarged the scope of the transaction cost theory developed by Coase to a general theory of industrial organisation bridging the gap between the societal and individual levels. The micro-analysis of Williamson (1975) aims at determining the efficiency of the different modes of organisation (markets, hybrids, firms, public agencies) in relation to the different types of transactions. He identified four dimensions of transactions that have significant impact on cost and hence on the potential mode of organisation: environment uncertainty, asset specificity, frequency of transactions and probity (Williamson, 1981; Williamson, 1999). Environment uncertainty is mainly related to Simon's behavioural assumptions referred to above. Asset specificity arises in various forms: physical, human, site specific, brand name capital and temporal assets (Williamson, 2010, p. 680). The higher the degree of asset specificity, uncertainty and frequency of occurrence of a transaction, the higher its market-mediated cost and hence the higher the potential is to be organised in a hierarchical form of organisation (Williamson, 2008, p. 47). When asset specificity and uncertainty are high, the transaction is organised in the form of private enterprise. If asset specificity and uncertainty are too high to be accommodated by a private firm, the transaction is organised by regulation (Williamson, 1999). Regulation is usually used to help consumers to overcome information asymmetry or the problem of asset specificity. Finally, Williamson added probity as the fourth dimension that favours public hierarchies (public agencies) over private hierarchies (firms) when it is needed (Williamson, 1999).

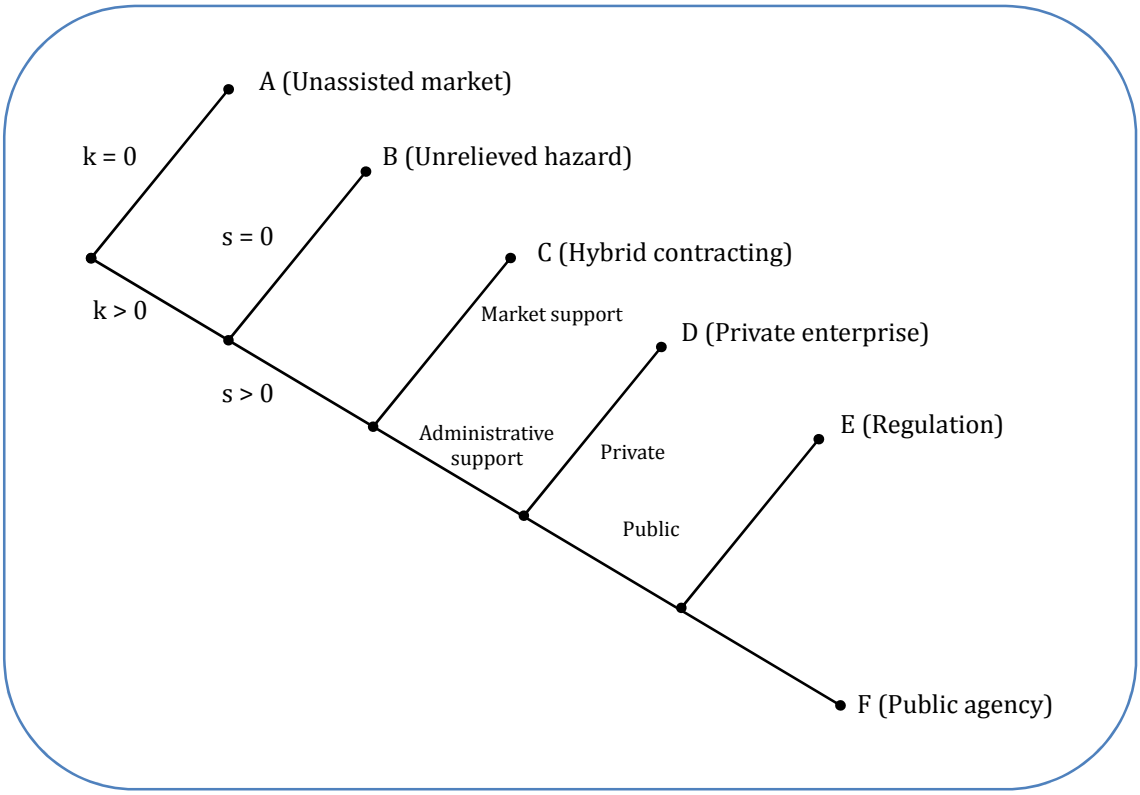


Diagram 3-1: Contracting schema and organisation (Williamson, 1999)

In a heuristic way, the consequences of organising transactions as a function of asset specificity (k) is depicted in Diagram 3-1. Node A depicts an ideal market transaction where there is no asset specificity and hence no need for safeguards (s). As asset specificity builds up, contract hazards increase. In node B suppliers attach risk premium instead of the inclusion of contractual safeguards. To the contrary, in node C, contracting parties choose to add contractual safeguards. Moreover, when asset specificity increases more, we reach node D where they internalise the transaction in a private enterprise. When asset specificity is extremely high and information asymmetry is prevalent, the government intervenes by organising this type of transaction through regulation. Finally, if probity is an essential condition of the transaction, public bureaucracy becomes the more optimal structure.

Moreover, the decision of a firm to outsource a good or a service or to integrate its production vertically into its structure is subject to the same rule of transaction cost minimisation (Jaskow, 1993, pp. 121-122). Moreover, the adoption

of new technology in an enterprise will depend on its perceived potential contribution to reducing its transaction costs in the light of its asset specificity (Williamson, 1988, p. 357). Based on this analysis Williamson derived a model of institutional governance structure enterprises mapping the logic according to which it uses its assets. This micro-level institutional governance structure is also composed of formal institutions and informal institutions. While formal institutions at this micro-level are the internal regulations of the organisation, informal institutions refer to organisational culture (Ménard, 2008, p. 290). This micro-level governance institutional structure stimulates organisation actions by two incentives: the potential impact of this action on reducing its transaction costs (Williamson, 1988, p. 357) and the future opportunities for investment in case of a profit-seeking organisation (Medhok, 2002, p. 541).

1.2.2 Social Institutional Change

The social institutional change model maps the dynamics of the interaction between social context and agents. In general, institutional change can result from a change in any component of the institutional framework. While institutional change that results from a change in informal institutions is called spontaneous (organic), a change that emerges from change in formal institutions is referred to as intentional (designed). Spontaneous institutional change emerges as an intended result from the pursuit by the individual actors of their self-interest (Greif, 2008). This type of change is more probable to develop in the long run but in the short run it can occur at small scales (local level or organisational level) or at early stages of development (Williamson, 2000). Intentional institutional change results from intentional design and collective action from groups of individuals (Greif, 2008). This type of change usually develops over periods that range from a decade to a century (Williamson, 2000).

NIE focuses on intentional institutional change, which has been analysed thoroughly by Douglas North. Intentional institutional change refers to a deliberate process that is guided by the perceptions of the actors about the impact of their collective actions on their interests (North, 2008). This process aims at modifying

the institutional framework through a change in formal institutions. This change caused the continuous interaction between actors and institutions. On one side, institutions provide the incentive structure which constrains the choices of agents (North, 1990). On the other side, agents seek to change institutions either to improve their returns or as a response to external changes (North, 2008). However, individuals generally do not have sufficient capacity to incur actions that can induce institutional changes. Therefore, individuals need to join their efforts to form organisations to stimulate such changes (North, 1990). Nevertheless, not all organisations are capable of changing the institutional framework. Only organisation that have, or can develop, sufficient power can induce changes in the institutional framework (North, 1990).

The institutional framework has a tendency towards stability because one of its main functions is to reduce uncertainty. This tendency towards stability usually originated in the resistance of informal institutions to change. Societies originally develop informal institutions to complement, explain, or in some cases to adapt existing formal institutions (North, 1990). However, when agents internalise these informal constraints, these informal institutions act as main determinants in their internal process of formation of their perception (North, 2008). Moreover, these institutions gradually become deeply enrooted and persistent to change (North, 2008). Therefore, since intentional institutional change begins by changing formal institutions, it causes a disequilibrium. This disequilibrium results from the incompatibility between the new choice matrix formulated by the change in transaction costs by the new formal rules and the mental perceptions influenced by the persistent informal institutions (North, 1990). This tension between formal and informal institutions continues until the evolution of a new point of equilibrium that restores the homogeneity between formal and informal institutions. At this new equilibrium point, a new institutional mix will evolve to restore the institutional stability.

1.2.3 Institutional Analysis and Development (IAD) Framework

1.2.3.1 IAD Model

The IAD framework has been developed by Elinor Ostrom (1990); it combines institutional analysis with game theory. Ostrom has built a model for the structure and dynamics of strategic interaction. The focal point of analysis of the framework is a conceptual unit called an action arena, composed of an action situation and actors involved in that situation (Ostrom, 2008). Firstly, an action situation refers to the social space where actors with diverse preferences interact, whether by exchanging goods and services or by engaging in appropriation and provision activities (Ostrom, 2005). The basic variables of an action situation are: participants, positions, actions, potential outcomes, transformation functions, information and the costs and benefits related to actions and outcomes (Ostrom, et al., 1994). Participants are the actors, whether individuals or organisations, who participate in this particular action situation (Ostrom, 2005). The ascribed or acquired characteristics of the participants are referred to as their attributes (Ostrom, 2005). Positions are anonymous place holders with an authorised set of actions and a particular level of information availability that can be associated to participants (Ostrom, et al., 1994). Actions refer to the array of actions which participants in particular positions can take at any particular stage, called decision nodes, in the decision process (Ostrom, 2005). Potential outcomes refer to the outcome that participants can influence through their interaction, such as the physical conditions of irrigation system or productivity of common resource (Ostrom, et al., 1994). Transformation functions refer to the set of functions that link the actions of the participants at decision nodes into intermediate or final potential outcomes (Ostrom, et al., 1994). Whether the information that each participant possesses about the action situation is considered complete or incomplete is crucial in determining the actions and the outcome of the decision process (Ostrom, 2005). Finally, the last variable refers to the set of payoffs that weighs the costs to the benefits of outcomes (Ostrom, et al., 1994). Secondly, the analysis of an individual or organisational actor involves four clusters of variable: the resources that actors

introduce to the action situation; the valuations that actors assign to actions and potential outcomes; the means by which actors acquire, process, maintain and use information; and the selection criteria for choosing a particular action or strategy (Ostrom, et al., 1994).

Ostrom has followed the definition of institutions introduced by North, but enlarged the concept of institutions to include not only rules (formal institutions) and norms (informal institutions) but also the strategies of actors (Crawford & Ostrom, 1995). According to her, rules are "shared prescriptions … that are mutually understood and enforced in particular situations in a predictable way by the agents responsible for monitoring conduct and for imposing sanctions" (Ostrom, 2008, p. 824). Norms are also shared prescriptions that are recognised and accepted by the majority of the participants in an action situation but entail intrinsic costs and benefits instead of material sanctions (Ostrom, 2008). Finally, strategies are the regularised plans developed by actors within the incentive structure produced by the surrounding institutional environment and the expectations of the probable behaviour of others in a situation influenced by relevant physical and material conditions (Ostrom, 2008).

After mapping the initial structure of an action arena, the analysis should perform two more tasks. Firstly, it should examine the factors that affect this structure. These factors include the institutions (rules and norms) that actors use to order their relationships, the attributes of the physical environment that are acted upon in this arena and the nature of the community hosting the action arena (Ostrom, 2008). Secondly, it must analyse the nested levels of institutions that affect the behaviour of actors (Ostrom, 2005). Using this model, Ostrom (1994) has shown how institutions can limit or expand the choices of actors in common-pool resources games and how it may affect the outcome of these strategic games.

1.2.3.2 Common-pool Resources Games

Ostrom et al. (1994) used these collective-action game models to analyse common-pool resources (CPR) problems. Three games that address the main common-pool resources problems will be reviewed in the following section. These problems are: appropriation externality, assignment and resource provision.

1.2.3.2.1 Appropriation Externality Problem

Appropriation problems refer the production relationship among CPR in which the increased appropriation by appropriators decreases the yield received by other appropriators for any given level of appropriation activity (Ostrom, et al., 1994). Although there is a common prediction that this CPR appropriation externality leads to an over-appropriation problem, in-depth analysis shows that it can evolve in various patterns. The CPR appropriation problem stems from the economic hypothesis that appropriators will ignore the effect of their choices on the other players. However, this does not mean that appropriators ignore the possible actions of the other players. This awareness of others' actions and external opportunities available to the players will determine the pattern of the evolution of the resource use.

Ostrom et al. (1994) have shown the different possibilities of the development of CPR appropriation with a two-player game that maps a simplified version of the problem. In this game, each player has two strategies to invest his one unit of a productive input that can be labour, capital or both in the CPR or in outside opportunity. The game assumes that the output from the CPR is a function of the total investment by players but subject to diminishing returns to scale. Clearly, if the CPR has economic value, then the payoff of a player invested in the CPR will be higher than his payoff from the external opportunity (w). One available strategy for each appropriator is to invest this token in outside opportunity that will give him a safe payoff (w). The other available strategy for each player is to invest his token in appropriating the CPR. Nevertheless, the payoff of this strategy will depend on the strategy adopted by the other player. If one player, say player 1, invested his token in

the CPR and the other, say player 2, invested his token in the outside opportunity then player 1 will receive a payoff F(1) and player 2 will receive w. If both players invest their tokens in the CPR then the payoff of each of them will be F(2)/2. This game is depicted in Table 3-1 with arrows showing the preferences of players towards the available options. Since the resource has economic value, i.e. F(1) > w, it is better to invest the first token, by either of the players, in the CPR rather than in the external opportunity. Therefore, the outcome (w, w) cannot be an equilibrium outcome for neither player as depicted by the arrow pattern. However, the final equilibrium of this game depends on the relationship between (F2)/2 and w.

		Player 2	
		CPI	External Opportunity
Player 1	CPI	F(2)/2 , F(2)/2	F(1) , w
	External Opportunity	w , F(1)	w , w

Table 3-1: Appropriation externality (Ostrom, et al., 1994).

If the CPR exhibits a sharply diminishing return so that (F2)/2 < w, then we will have two possible equilibrium outcomes at (F(1), w) and (w, F(1)). In each of these two outcomes, one player invests his token in the CPR and the other invests in the outside opportunity. The game that evolves in this case will be a Chicken game (Table 3-2).

		Player 2	
Player 1		F(2)/2 , F(2)/2	F(1) , w ★
	★	w , F(1)	w , w

Table 3-2: Appropriation externality – Chicken game (Ostrom, et al., 1994).

On the other hand, when the CPR has smoothly diminishing returns so that (F2)/2 > w, there will be only one Nash equilibrium at (F(2)/2, F(2)/2). In such a case, both actors invest their token in the CPR. The game that results in this case will be a Prisoners' Dilemma game (Table 3-3).

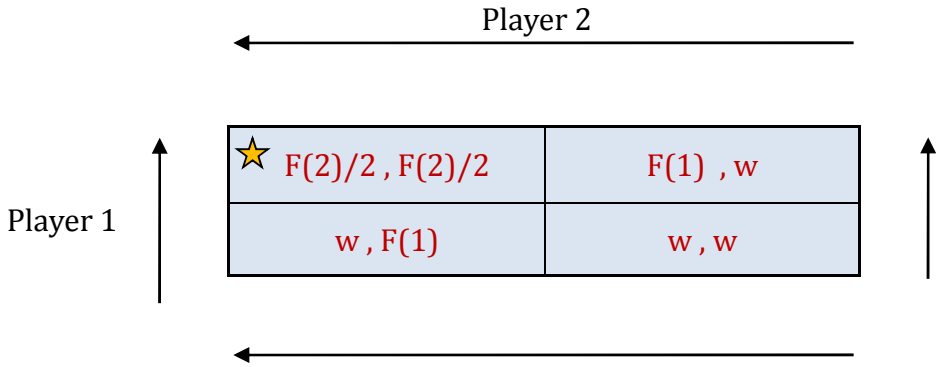


Table 3-3: Appropriation externality – Prisoner's dilemma game (Ostrom, et al., 1994).

1.2.3.2.2 Assignment Problem

The Assignment problem arises in a CPR that is characterised by a heterogeneous distribution of its resource units in a way that affects the productivity of the different locations of the resource (Ostrom, et al., 1994). In this type of resource, the pattern of interaction between appropriators depends on the degree of the variability of productivity among the different spots of the resource. Ostrom et al. (1994) have also shown the different patterns of the interactions among appropriators with a two-player game that maps a simplified version of the fishing grounds problem. These fishing grounds have two spots: spot 1 and spot 2. The value of fishing in spot 1 is (V_1), which is higher than the value of fishing in spot 2 (V_2). When the two players use the same spot of the grounds for fishing, they split the value of this spot. When each of them resorts to a different spot, each one appropriates the whole fishing value of that spot. This game is depicted in Table 3-4 with arrows showing the general preferences of players towards the available options regardless of the relationship. As indicated by arrows, the outcome ($V_2/2$, $V_2/2$) cannot be an equilibrium outcome for either player. However, the final equilibrium of this game depends on the relationship between V_1 and V_2.

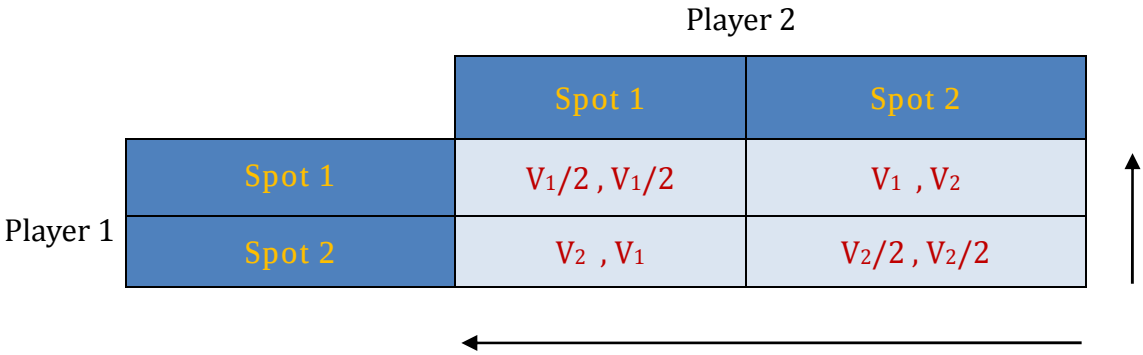


Table 3-4: Assignment problem (Ostrom, et al., 1994).

The first possible scenario, depicted by Table 3-5, occurs when the value of fishing in spot 1 is much higher than that of spot 2 so that $V_1 > 2(V_2)$. In this case, both players will prefer to go the spot of the higher fishing value. In other words, both of them have a dominant strategy to use spot 1 for appropriation with an equilibrium outcome of $(V_1/2, V_1/2)$. This situation is problematic from the social point of view as it results in a total payoff of V_1 whereas two better outcomes of value $(V_1 + V_2)$ can be achieved if each of them uses a different fishing spot, i.e. (V_1, V_2) or (V_2, V_1). In other words, the Nash equilibrium of this game does not satisfy the Pareto optimality condition.

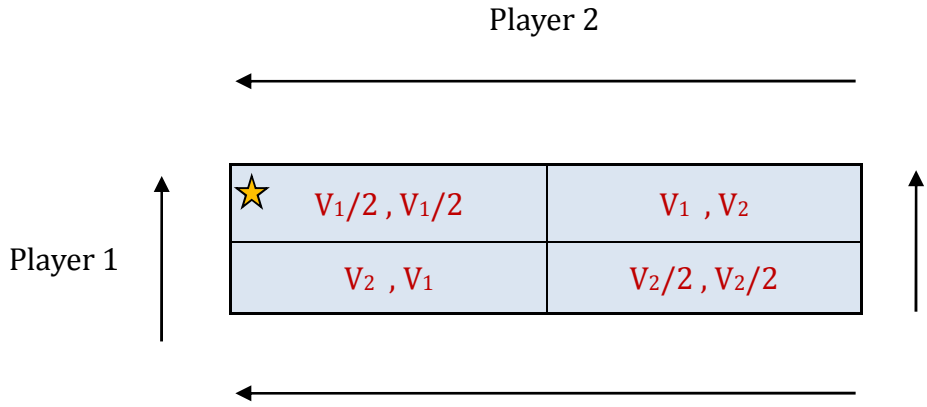


Table 3-5: Assignment problem – First scenario (Ostrom, et al., 1994).

The second scenario occurs when the value of fishing in spot 1 is higher than that of spot 2 but $V_1 = 2(V_2)$. In this borderline case, portrayed by Table 3-6, players

will be indifferent between three possible outcomes [($V_1/2$, $V_1/2$), (V_1, V_2), (V_2, V_1)].

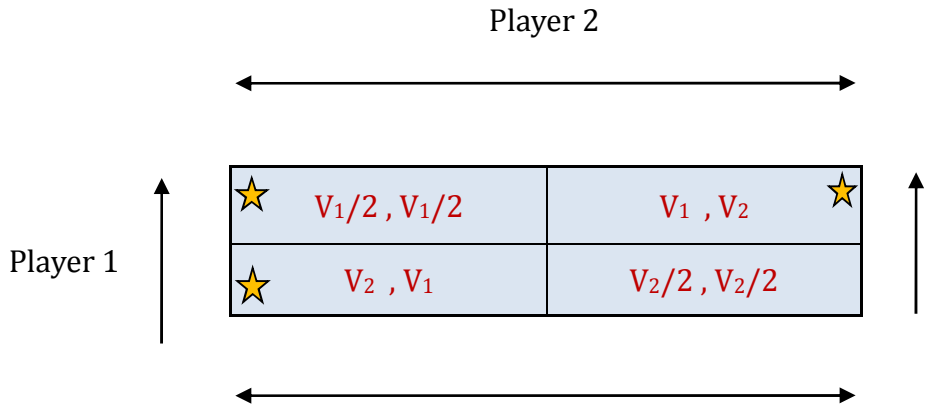


Table 3-6: Assignment problem – Second scenario (Ostrom, et al., 1994).

Finally, the game, depicted by Table 3-7, evolves to a Chicken game when $V_1 < 2(V_2)$. In this game neither of the players has a dominant strategy. The game can result in two possible equilibrium outcomes [(V_1, V_2) or (V_2, V_1)].

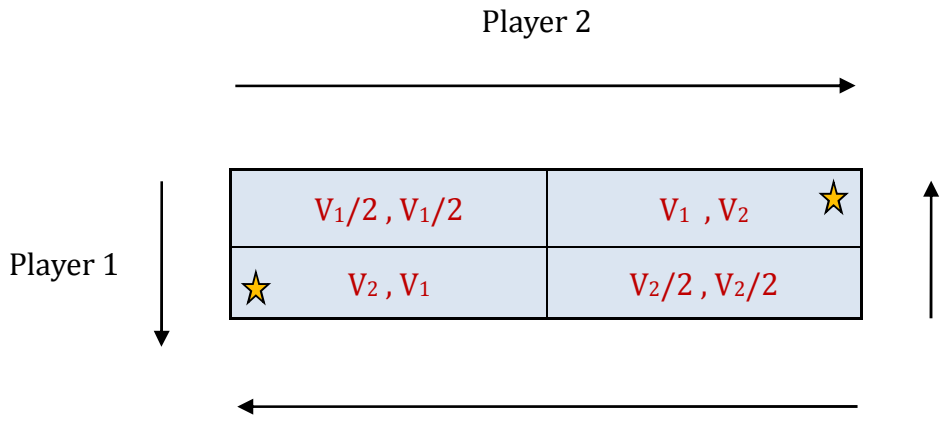


Table 3-7: Assignment problem – Chicken game (Ostrom, et al., 1994).

1.2.3.2.3 Resource Provision Game

The cornerstone of provision problems is the analysis of the benefits of provision of the facility in comparison to its costs to the beneficiaries. In general, the

provision problems are similar to those of public goods. Ostrom et al. (1994) have shown the different potential scenarios of CPR provision with a two-player game in which each player has two strategies to invest his one unit of a productive input to contribute to provision or in outside opportunity. Like the appropriation game, the provision game assumes that the output from the CPR is a function of the total investment by players. Nevertheless, the payoff of players is independent of their personal contribution to the provision project. For each unit invested in the CPR, each player receives a payoff of (v). One available strategy for each appropriator is to invest this token in outside opportunity that will give him a safe payoff (w) in addition to the payoff that he gets from the contribution of the other player to the provision project. The other available strategy for each player is to invest his in provision of the CPR. If one player, say player 1, invested his token in the CPR and the other, say player 2 invested in the outside opportunity then player 1 will receive a payoff v and player 2 will receive (w +v). If both players invest their tokens in the CPR then the payoff of each of them will be (2v). Two possible scenarios can evolve here depending on the relation between (w) and (v).

		CPI	External Opportunity
Player 1	CPI	2v , 2v	v , w+v
	External Opportunity	w+v , v	w , w ★

Table 3-8: Provision problem – Prisoners' dilemma Game (Ostrom, et al., 1994).

The first scenario arises when (2v > w> v) and is mapped in Table 3-8. This case represents a parameterisation of the prisoners' dilemma in which both appropriators have dominant strategies not to contribute. This game results in a

sub-optimal Nash equilibrium of (w, w) although both would be better off if they contributed.

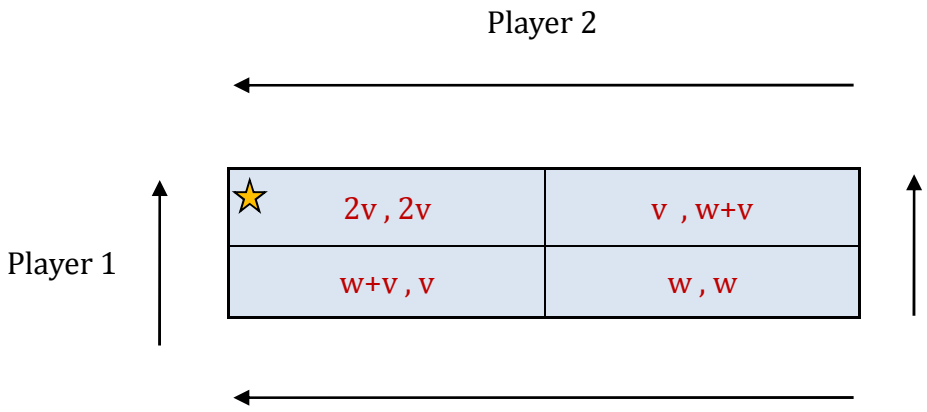


Table 3-9: Provision problem – optimal equilibrium (Ostrom, et al., 1994).

The second scenario is the optimal scenario that evolves in the case of having (2v>v>w). In this case both appropriators have incentive to contribute to the resource provision. The result is the optimal Nash equilibrium that is depicted in Table 3-9.

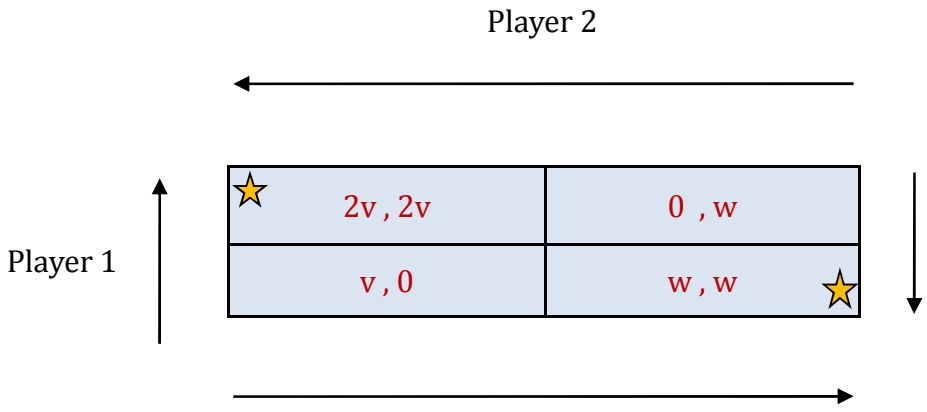


Table 3-10: Provision problem – Assurance game (Ostrom, et al., 1994).

Another shape of the game can occur if the provision can only be achieved if the two players contribute. In other words, if the players contribute, the payoff is 2v. Nevertheless, if only one contributes, then the provision project is unachievable and therefore the payoff is 0 for both players. There are two major equilibrium outcomes in this game: an assurance game and low economic value of the resource. The assurance game, depicted in Table 3-10, evolves when (2v> w). In this case, each

player has no incentive to contribute if he knows that the other will not. However, there is incentive for him to contribute if he knows that the other appropriators will contribute.

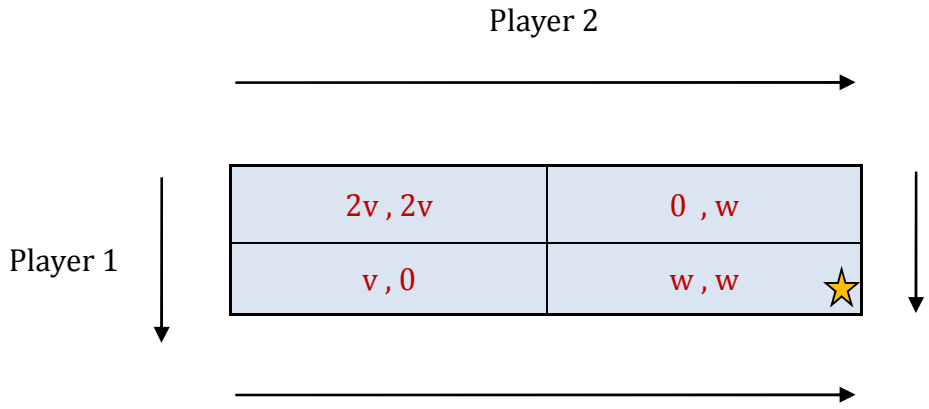


Table 3-11: Provision problem – Low-economic value resource (Ostrom, et al., 1994).

The other equilibrium outcome results when the resource of is low economic value so that (w >2v). In this case, mapped by Table 3-11, neither of the appropriators would contribute as the resource represents no economic opportunity for them.

1.2.3.3 Institutions and Games

Games in action situations are controlled by two types of rules: physical and institutional. Physical rules determine "what is physically necessary, possible, or impossible to do" (Ostrom, et al., 1994, p. 75). Institutional rules, or simply institutions, determine the actions or outcomes that are obligatory, permitted, or prohibited (Crawford & Ostrom, 1995). Moreover, they define the mechanisms to enforce these rules, including the sanctions authorised if rules are not followed (Crawford & Ostrom, 1995). Seven broad classes of rules can affect the structure of an action situation (Ostrom, et al., 1994). First, position rules creates a set of positions and determine the number of participants who can hold each position (Ostrom & Crawford, 2005). Second, boundary rules determine how an actor enters or leaves each position (Ostrom, et al., 1994). Third, authority rules assign a set of action for each position at each node of a decision tree (Ostrom, et al., 1994). Fourth, aggregation rules define the transformation function that is employed at a particular

node to transform actions into outcomes (Ostrom, et al., 1994). Fifth, scope rules designate the outcomes that must, must not, or may be affected by the action situation (Ostrom & Crawford, 2005). Sixth, information rules determine the information available to each position at each stage of a game (Ostrom, et al., 1994). Last, payoff rules define how benefits and cost are required, allowed or prohibited to players based on the actions and outcomes of the game (Ostrom, et al., 1994).

These seven layers of rules work in such a way that a change in one of them influences the work of others (Ostrom, et al., 1994). Therefore, they need to be considered as a full rule configuration rather than single independent rules (Ostrom & Crawford, 2005). However, rules do not always exist in all layers of an action situation. Therefore, a default condition is established in the case of absence of rule in this layer of rules (Ostrom, et al., 1994). Ostrom has identified seven default conditions that can be assumed in a general legal system that presumes general freedom unless a restriction is specified (Table 3-12).

Default Position Condition	Only one position exists
Default Boundary Condition	Each player can occupy only one position
Default Authority Condition	Each player can take any physically possible action
Default Aggregation Condition	Players act independently. Physical relationships determine the aggregation of individual moves into outcome
Default Scope Condition	Each player can affect any physically possible state of the world.
Default Information Condition	Each player can know the consequences of his actions and others' actions
Default Payoff Condition	Each player can retain any outcome that he can physically obtain and defend

Table 3-12: Default conditions.

1.3 Critical Assessment

Two main strengths of the NIE framework are relevant for this analysis. Firstly, it has a distinctive capacity to link the macro and micro contexts of social policy with the individual's welfare. Secondly, the NIE analytical framework deals with policy and regulation change, a sub-process of the larger process of intentional social change of development. Therefore, unlike some analytical frameworks that provide static analysis for a policy outcome, the NIE provides a dynamic theory of institutional change that can trace the roots of this outcome through the interaction between a policy action and its social context over the lifetime of this policy.

However, NIE has some limitations that can be traced to its behavioural approach and informational base. These limitations are related to its utility-based motivation analysis and its institutional change model.

The first limitation is the embrace of utilitarian principles as the

informational basis of the NIE behavioural analysis. This limitation is multi-faceted. Firstly, although utility was originally perceived as happiness or as self-satisfaction, the difficulty of measuring both of them has seen it converted into numerical measures of revealed preferences or observable choice (Sen, 1985). This has converted the utility approach to wellbeing to a real-income approach that ignores the role of personal differences and context variations in shaping people's valuation of wellbeing (Sen, 1999). Secondly, although NIE has widened the utility concept to take into consideration cultural and altruistic motivations, some important sources of motivations have been ignored, such as moral rules and identity. The motivation of an individual may include moral values that stem only from his or her aptitude to do the right thing (Alkire & Deneulin, 2002). Although the NIE has attempted to endogenise human behaviour by assuming that the utility function and hence human behaviour is shaped by institutional context (Cleaver, 2007), the NIE excludes the effect of life experiences and social interactions on the preferences of individuals. The expression of community or group identity can also underlie human behaviour (Alkire & Deneulin, 2002). For example, group formation and experiences affect members' perceptions of wellbeing and therefore influence their behaviour (Forsyth, 2006). Therefore, it is argued that identity is constructed dialogically, through a process of mutual recognition, in which recognition of the other is crucial to the development of sense of self (Fraser, 2000). Even altruism does not necessarily have to be explained by utility; it could stem from the moral or material association of an individual with others. The argument here is that a person's motivation cannot be reduced to his/her material needs modelled by a utility function.

The third limitation is related to the third dimension of the institutional change model: the lack of normative dimension and its weak emphasis on individual wellbeing. Firstly, the absence of a normative dimension in its social change model has been a major criticism of the NIE. The institutional change model focuses on the stability of micro and macro institutional structures as an ultimate aim and ignores the equity dimension of outcome (Cleaver, 2007). The institutional change model ignores the inequalities of participation in the institutional change and of outcome.

The NIE also has not dealt with the inequality among actors as it dealt with people as rule makers and rule followers (Ostrom, 2005). Secondly, although the changes in individuals' wellbeing has been one of the main pillars of the institutional analysis of social change, these changes have been dealt with mainly as one of the explanatory factors of social change. The improvement of individuals' wellbeing has not received sufficient analysis as a major objective of social change. Moreover, it ignores the agency role that some rule-following group can play in challenging the dominant institutions. For example, particular subordinated groups may challenge the dominant culture that is humiliating them and impeding them from a just share of distribution (Fraser, 2000). Not only do these inequalities have an intrinsic moral importance but they also have instrumental importance because social justice is important for people's wellbeing and its absence is a potential source of social instability (Stewart, 2005); for example, the conditions of marginalised subjects whose experiences of subjectivity play an important role in mobilising certain aspects of their identities, which serve as a base for their collective action (Nash, 2008).

2 Capability Approach

2.1 Overview

Amartya Sen developed the capability approach as a normative approach to development in 1990s. He argues that development can be viewed as "a process of expanding the real freedoms that people enjoy" (Sen, 1999, p. 1). He indicates that an individual's assessment of social arrangements is based on his evaluation of his actual achievement and his freedom to achieve what he values within these social arrangements (Sen, 1992). "The various things a person may value doing or being" (Sen, 1999, p. 75) are called functionings. Functionings can be elementary, such as being healthy or appropriately nourished, or more complex activities or states, such as participating in social life or preserving self-respect (Sen, 1999). The substantive freedoms which an individual values or has a reason to value are described as capabilities (Sen, 1999). Capabilities are "the various combinations of functionings (beings or doings) that the person can achieve" (Sen, 1992, p. 40). Therefore, the impact of any social context must be evaluated based on whether it enhances or limits the capabilities of people (Sen, 1984).

Capability expansion is important for its value for a person. However, this is not the only significance of capability expansion as it has an instrumental role in enhancing the ability of this person to achieve better outcomes and to influence their environment (Sen, 1999). This instrumental role of freedom is related to two dimensions of the individual: wellbeing and agency. The wellbeing dimension describes "the person's achievements and opportunities in the context of his or her personal advantage" (Sen, 1987, pp. 58-59). The agency dimension refers to "what the person is free to do and achieve in pursuit of whatever goals or values he or she regards as important" (Sen, 1985). It is important to note that the agency dimension enlarges the concept of valued freedoms to include the freedom of people to seek achievements other than those which serve their own interests (Ibrahim, 2006). Thus, a person's agency describes his or her role, as a responsible member of the community, in participating in individual or collective activities in the economic,

social and political fields (Sen, 1999). Therefore, policies that seek the enhancement of people's capabilities have the advantage of dealing with people as agents of change and not as passive subjects (Sen, 1999). Therefore the enhancement of people's capabilities helps them to improve their lives and to participate in developing their communities (Sen, 1999).

2.2 Critical Assessment

The capability approach has strengths as well as some weaknesses. The main strength of the capability approach is having normative dimensions that deal with individual wellbeing as the main objective for the evaluation of public actions. Secondly, the capability approach enlarges the informational base used for evaluation of wellbeing. It expands this informational base to include people's freedoms and achievements (Ibrahim, 2011). In this way, the approach takes into consideration personal differences and heterogeneities of context.

However, Sen's capability approach has been criticised for being individualistic and for lacking a dynamic model for social change. Firstly, concerning the individualistic character of the approach, Ballet et al. (2007) clarified that each person is immersed in a social network that determines his or her obligations that must be satisfied to enjoy his or her rights. Moreover, Evans (2002) emphasised that the most effective way to challenge the constraints embedded in formal and informal institutions is to develop dynamic associational groups that enable the less privileged individuals to develop their own distinctive preferences and seek their goals. Nussbaum (2000) has included affiliation as one of the basic capabilities of each individual. A person needs to be able live with others, to recognise their concerns and to sympathise with them (Nussbaum, 2000). Therefore, what is good for other people represents a constraint on the individual's pursuit of his own good but is also a part of his good (Nussbaum, 2006). Ballet et al. (2007) define responsibility as "the capability to feel and be responsible, not only ex-post (i.e. once freedom has been exercised), but also ex-ante, by the capacity to exercise self-constraint on a voluntary basis in order to satisfy one's obligations towards others". Secondly, the capability approach does not encompass an analytical framework that

maps the rules that govern the continuous interaction between social arrangements and actors. Though Sen (1999) has integrated the concept of institutions in the capability approach, this integration did not grasp the institutional change model included in the new institutional economics. Therefore, the analysis of social change questions using the capability approach requires integration with other explanatory theories (Robeyns, 2005).

3 Rationale for the Integration of the NIE and the CA

The new institutional economics and the capability approach are two complementary frameworks. On one side, the new institutional economics is a theoretical perspective that encompasses two theoretical building blocks. The first is an analytical framework for the relation between the social and organisational contexts and actors. The second is a dynamic model that can analyse the interaction between policy change and its social and organisational contexts. On the other side, the capability approach is a normative people-centred approach, analysing the relation between the individual's wellbeing and his or her social and organisational contexts. This normative character of the capability approach can enrich the new institutional economics by enlarging its information base from utilities to capabilities. Therefore, the integration of the capability approach into the new institutional economics balances its orientation between social structures and human actors and enriches its informational space. At the same time the new institutional economics will maintain its capacity of providing coherent analysis of the dynamic social change. Thus, this study will employ an integrated framework that merges the capability approach into the NIE-based framework.

CHAPTER 4

ANALYTICAL FRAMEWORK AND METHODOLOGY

1 Analytical Framework

The merged analytical framework used in the study is developed in two steps. First, the IAD framework will be dismantled into two components: a static model and a dynamic model. The static model is the institutional analysis of action arena (IAAA). The dynamic model is the strategic institutional development model (SID). Consequently, the IAAA model and the CA will be integrated into the institutional framework model of the NIE. The strategic institutional development model and the social institutional change model will be combined in a single multi-layer institutional change model. Furthermore, some adaptations will be integrated to these models to overcome some of their limitations.

1.1 Institutional Framework

The adapted NIE framework used in this study is segmented into four analytical levels (Diagram 4-1). These levels are modelled by four sub-models: trans-boundary institutional structure, macro-level national institutional environment, micro-level governance institutional structure and an individual-level framework based on the capability approach.

1.1.1 Trans-boundary Common Resource Institutional Structure

The sub-model will be analysed using the institutional analysis of an action arena (IAAA) model. This sub-model has three structural components. In the first component the physical environments that act upon the CPR are examined. The attributes of the physical environment that affect the action arena include: the size of the common resource, the number of appropriators in the resource system, the temporal and spatial variability of the resource units in the resource system, the current state of the common resource, economic conditions of resource units, and the availability of data about the resource system (Ostrom, 1990). The second component of the sub-model is the institutional environment of the common

resource. This layer includes the status quo of formal and informal institutions that regulate the trans-boundary resource system. The third component is the pattern of distribution of common-resource benefits among riparian interests under the status quo trans-boundary institutions. The component has three parameters: the average flow of resource unit to each appropriator, the variability of flow of resource unit to each appropriator, and the quality of flow of resources received by each appropriator.

1.1.2 National-level Institutional Environment

This sub-model relies on the institutional environment model of North. However, it enlarges the scope of informal institutions to include the non-utility sources of motivations. This will be achieved by widening the scope of cognitive informal institutions to encompass non-utility motivations such as moral rules. Furthermore, beliefs that grew as a result of the interaction between actors and their organisational and social contexts will also be included in the cognitive informal institutions in order to grasp the agency dimension of human beliefs.

1.1.3 Governance Institutional Structure

This sub-model adopts a variant of Williamson's model that was developed mainly by Pablo T. Spiller and Claude Ménard to analyse the institutional foundations of regulation with special focus on utilities. Spiller (2009) identifies the political institutional dynamics that constrain the regulation of utilities. Ménard (2009) focuses on developing a model that maps the relation between technical and organisational requirements of the water sector.

Spiller´s model identifies the proper institutional setting for utilities according to their main characteristics. Utilities are characterised by three main features: economies of scale and scope; massive consumption and high asset specificity (Spiller & Tommasi, 2008). First, economies of scale and scope are among the main features of utility sectors. Economies of scale in utility sectors refers to the decrease in marginal costs to a utility service provider as a result of the increase in its production and distribution network size (Graham, et al., 2003). Economies of

scope refers to the possibility of using a particular utility network by another utility sector, such as transmitting information through insulated cables installed in a water network (Ménard, 2009). Both economies of scale and scope limit the number of service providers in utility sectors. This, in turn, limits competition information availability in the utilities market. Combined with this information asymmetry, the high asset specificity creates contracting hazards that imply regulation as a contracting mechanism according to Williamson's contracting scheme. Second, the massive consumption of utility services implies that the set of consumers approximates the voting population of the country. Therefore, the pricing of utilities is always politicised because politicians will always take into consideration the impact of utilities prices on their voters. Third, the high asset specificity implies that a large proportion of the established utilities are considered as sunk costs and hence operators will be willing to continue working as long as their operating revenue exceeds their operating costs. Thus, governments can act opportunistically towards the private company to serve their political interests. This opportunistic behaviour can take the form of administrative appropriation through setting prices below long-run average cost or it can take the form of specific requirements such as equipment purchase or labour contract conditions (Levy & Spiller, 1994). If investors face the risk of opportunism they will not invest, demand strong safeguards or advance compensation for that potential risk or under-invest in the quality of the service if they have been providing the service (Spiller, 2009). Moreover, in the absence of sufficient safeguards against government opportunism, public provision of the utility service becomes the equilibrium organisational mode (Levy & Spiller, 1994).

In addition to the abovementioned characteristics of utility sectors, the water sector has specific features that have led to it being subjected to tight regulations or public provision. Firstly, the water sector has higher asset specificity than many other utilities whose assets are more mobile, such as telecommunications (Spiller & Savedoff, 1999). Since most of the fixed assets of the sector have few alternative uses, the sunk costs of the water sector are very significant. Secondly, the degree of uncertainty is relatively high even in comparison with the other utilities (Ménard, 2009). Clearly, the uncertainty is caused partly by information asymmetry and the

high level of sunk costs that characterise water systems, the same as other utilities. However, there are two additional sources that make the degree of uncertainty higher than other utilities. The first is the vulnerability of the water sector to fluctuations in the physical environment, such as droughts (Ménard, 2009). The other source is the uncertainties created by human activities, such as pollution, that affect the physical environment and in turn affect water systems (Ménard, 2009). Thirdly, the high frequency of water supply transactions combined with the low rate of technological change implies that organisational solutions of the sector tend to be long-term commitments. Therefore, these three characteristics of the water sector imply that the transactional features of the water system are greater. Therefore, there has been a higher tendency for the internalisation of the core transactions of the sector, i.e. production, transportation and distribution, in tightly regulated private or public organisations (Ménard, 2009). Moreover, the water sector is not only characterised by economies of scope and scale but also by economies of density. Economies of density describes the decrease in average costs with the increase in the number of customers connected to the water network (Ménard, 2009). This makes water systems as close as possible to a natural monopoly especially at local level. Therefore, consumers will tend to suspect the intentions of the water service provider and will have concerns about its pricing and operational policy (Spiller & Savedoff, 1999). As a result, whether the water services provision is privately or publicly organised, the water sector tends to be highly politicised and vulnerable to government opportunism. This potential for government opportunism will require the government to design institutional arrangements in the form of regulations that will constrain its capacity to act opportunistically after investment takes place (Spiller & Tommasi, 2008). Therefore, institutional arrangements design should take the form of regulation that serves two purposes: constraining the potential for government opportunism and creating a balanced incentive structure for service providers.

Such regulations should balance between credibility and flexibility (Spiller & Savedoff, 1999). On the one hand, to be credible, regulations should be relatively fixed to provide investors with sufficient certainty concerning their future profits.

On the other hand, a certain degree of flexibility should be retained to permit governments to adjust regulation to changing conditions. The regulation framework structure has two components: regulatory governance and regulatory incentives (Levy & Spiller, 1994). Regulatory governance structure describes the mechanisms that societies adopt to constrain the discretionary power of government and to resolve disputes that result from these constraints. Regulatory incentives include the procedures and rules that govern utility pricing, consumer rights, quality standards and subsidies among other things. The absence of a credible regulatory framework will lead to a low-level equilibrium which is characterised by: low prices; limited government subsidies; low service quality, limited service expansion; operational inefficiency and corruption, which further erode public support (Spiller & Savedoff, 1999). Therefore, this low-level equilibrium tends to stability as no party, neither government, consumers nor investors, has an incentive to change this status quo. Moreover, this chronic inefficiency and poor performance eventually create the conditions for the government to take over the water system (Spiller & Savedoff, 1999). Institutional arrangements that have shown success to escape this low-level equilibrium trap are fragmentation, competition, and privatisation (Spiller & Savedoff, 1999). Clearly, the design of the regulatory framework and the choice between such institutional arrangements depends on the macro-level institutional framework.

1.1.4 Individual-level Model

The individual-level model merges the CA into the NIE framework by widening the definition of property rights. The NIE provides a general definition of property rights and does not adhere to its narrower legal sense (Eggertsson, 1996). Within the NIE framework, property rights are the rights of an actor to use valuable resources (Alchian & Demsetz, 1973, p. 17). Therefore, the endowments of actors are the economic resources owned and utilised by them (Sen, 1981). Institutions influence the ability of people to command and utilise their resources by mapping their incentive structures and the opportunity cost of their choices. Therefore, the institutional environment determines the opportunities and freedoms available for

people and hence plays a crucial role in dictating human capabilities (Sen, 1999). However, the relation between institutions and capabilities is not unidirectional. On the one hand, the institutional framework can constrain or expand people's capabilities through decreasing or increasing, respectively, the opportunity cost of their choices. On the other, people can use their freedom of agency to engage in collective action to induce institutional change (Ibrahim, 2006).

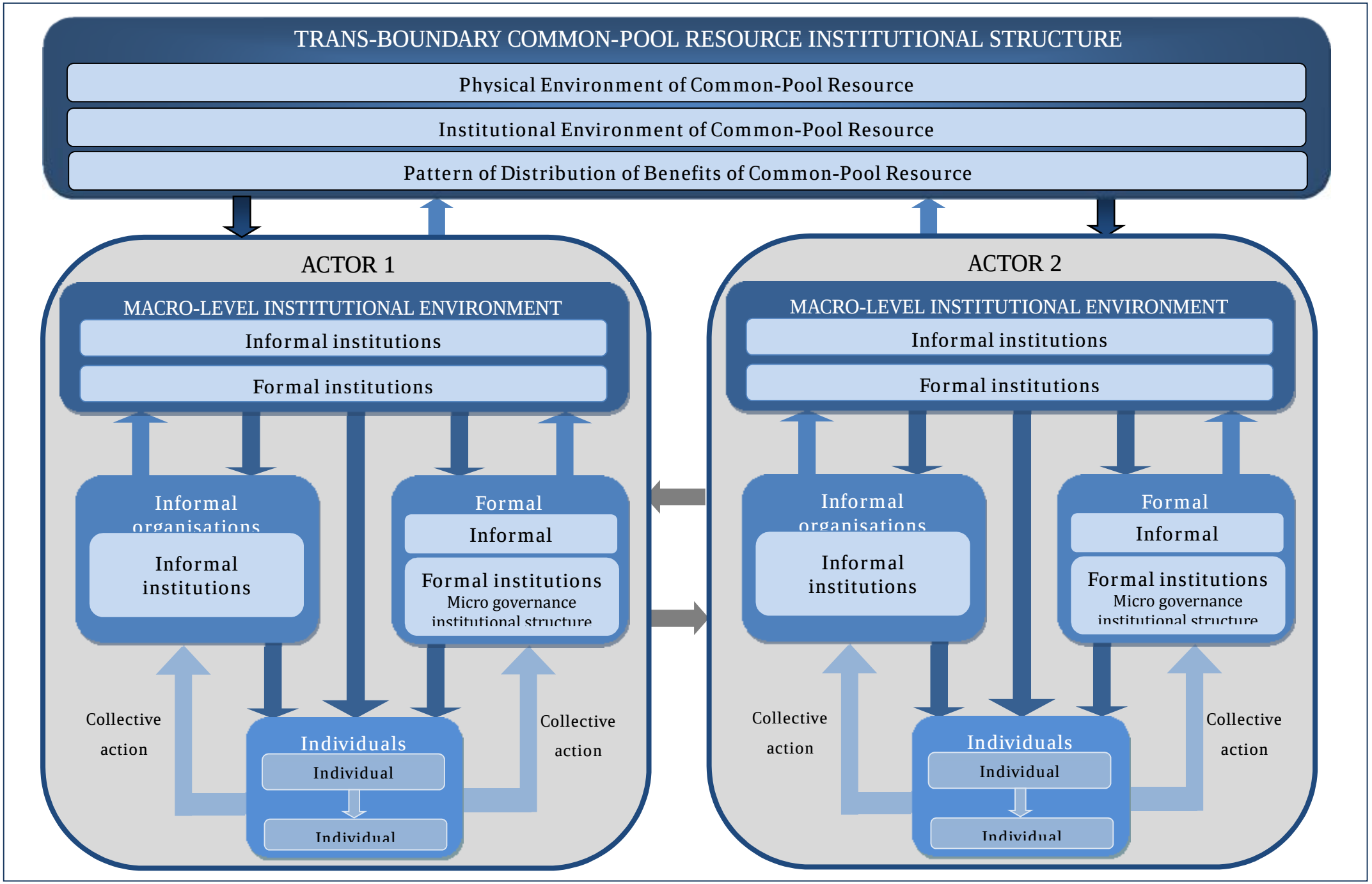


Diagram 4-1: Institutional framework model

1.2 Institutional Change

The institutional change model is composed of two sub-models. The first is the strategic institutional change model that analyses strategic interaction among state actors. The second is the social change that analyses the impact of the trans-boundary institutional change on the national institutional framework.

1.2.1 Strategic Institutional Change

An adapted conception of the strategic institutional development model (SID) developed by Ostrom (1990) will be used to model the strategic interaction of state actors in this study. In this adapted conception, the state actor's strategic action is determined by four internal variables: internal institutions, expected benefits, expected costs and discount rates (Diagram 4-2).

Internal institutions refer the macro institutional environment of each state actor that is related to the common resource. It includes the formal and informal institutions that constrain the state actors in their strategic interaction with actors in the common-resource action arena. Informal institutions that reinforce cooperation among actors are positively related to the proximity of the appropriators from the resources and the frequency of interaction among appropriators (Ostrom, 1990).

Evaluating the benefits expected from institutional change will be influenced by four parameters (Ostrom, 1990). The first is the predicted average flows and the predicted value of resource units under the proposed set of institutions as compared with the status quo institutions. The second parameter is the expected variability of the resource flow units under the new institutions as compared with that under the status quo institutions. The third measure is the difference in resource quality as a result of the institutional change. The decision parameter is the impact of institutional change on the state of conflict among actors.

To evaluate the expected costs of the institutional change the research will

adopt an adapted transactions cost concept (1937). These transaction costs can be divided into ex-ante transaction costs, negotiations costs and ex-post transaction costs (Coase, 1960). Ex-ante transaction costs comprise search costs and information costs. Search costs are the costs of identifying a suitable partner among the actors (Hobbs, 1997). Information costs refer to the costs of identifying the needs, the benefits and the services that can be provided by other partners (Downs & Mui, 1998). Clearly, these search and information collection costs depend mainly on the cost of acquiring, processing and communicating the information among partners (Chowdhury, 2002). Transformation costs are the costs of the resources dedicated to the process of considering the institutional change (Ostrom, 1990). This type of costs includes negotiation and decision costs. Transformation costs are proportional to the number of actors involved in the institutional change, the divergence of their interests, the minimum proportion of the actors needed to conduct the institutional change and the organisational cost of implementing the proposed institutions (Ostrom, 1990). They are inversely proportional to the number of skilful leaders in institutional change. Moreover, the informal institutions that guide the choice of appropriate strategies, whether confrontational or cooperative, in strategic interactions will affect the costs of achieving institutional change (Scharpf, 1997). The existing formal institutions will affect the transformation costs of the institutional change (Ostrom, et al., 1994). Ex-post transaction costs can be divided into monitoring costs and enforcement costs. Monitoring costs are the costs of ensuring that terms of transaction are fulfilled by both parties to the transaction (Hobbs, 1997). Enforcement costs are the costs of guaranteeing that unfulfilled terms of transactions are remedied (Downs & Mui, 1998). Ex-post transaction costs are determined by the physical attributes of the common resource such as its size and structure, the available technology for appropriation and exclusion and the proposed institutions (Ostrom, 1990).

Finally, each actor has its internal discount rate for evaluating expected benefits and costs. This internal discount rate is determined by the degree of the actor's dependency on the resource. The higher the dependency of an actor, the lower its discount rate (Ostrom, 1990). Moreover, it is also influenced by the

informal institution of each society. The higher the valuation of a society for the future, the lower its discount rate (Ostrom, 1990).

Based on each actor's evaluation of its net expected benefits of the proposed institutional change and those of the others, it will decide upon its strategy in the strategic interaction. The sum of strategies will shape the structure of the strategic game and the expected outcome.

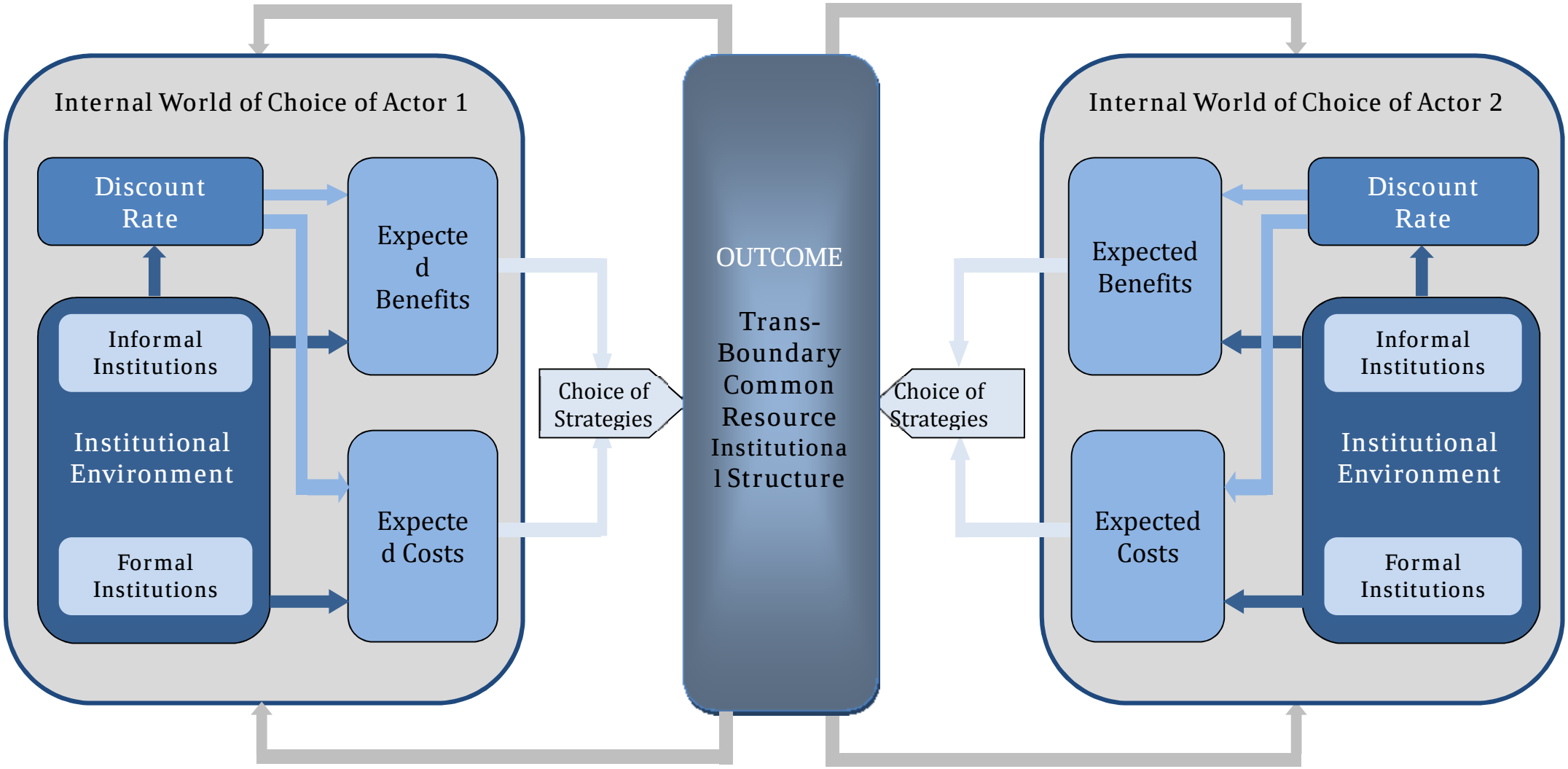


Diagram 4-2: Trans-boundary strategic institutional change

1.2.2 Social Institutional Change

This model adopts the institutional change model of North but introduces some adaptations to it. The main adaptation is the integration non-utility motivations to the incentives of agents for stimulating an institutional change. The model comprises the two sub-models of intentional institutional change presented by North (1990): continuous institutional change and discontinuous institutional change.

Continuous institutional change (Diagram 4-3) describes the gradual institutional change, which is caused by continuous incremental changes in formal institutions (North, 1990). This incremental change results from the *continuous* repetition of a two-step process. First, a small change is induced in formal institutions, resulting in the above-indicated disequilibrium. However, since this change is small, new informal institutions will develop over time to cope with the new formal institutions (North, 1990). Over time, the new institutional framework moves gradually towards the new formal institutions and gradually restores its equilibrium around it. The evolution path of this type of institutional change depends on the evolution of power relations among actors and the "tenacity of norms of behaviour" (North, 1990, p. 86). According to North, this pattern is the natural pattern of institutional change.

Discontinuous institutional change (Diagram 4-4) is stimulated by a radical change in formal institutions. The large magnitude of change in formal institutions creates a gap between it and the persistent informal institutions. This gap creates a strong resistance from the actors negatively affected by the new formal institutions (North, 1990). This resistance can produce violent actions if mediating institutions and organisations do not exist or do not have sufficient capacity to perform their roles. The result of such type of change is uncertain. However, it tends to restructure the institutional framework over time to restore its equilibrium at a new point that lies between the new formal institutions and the persistent informal institutions (North, 1990).

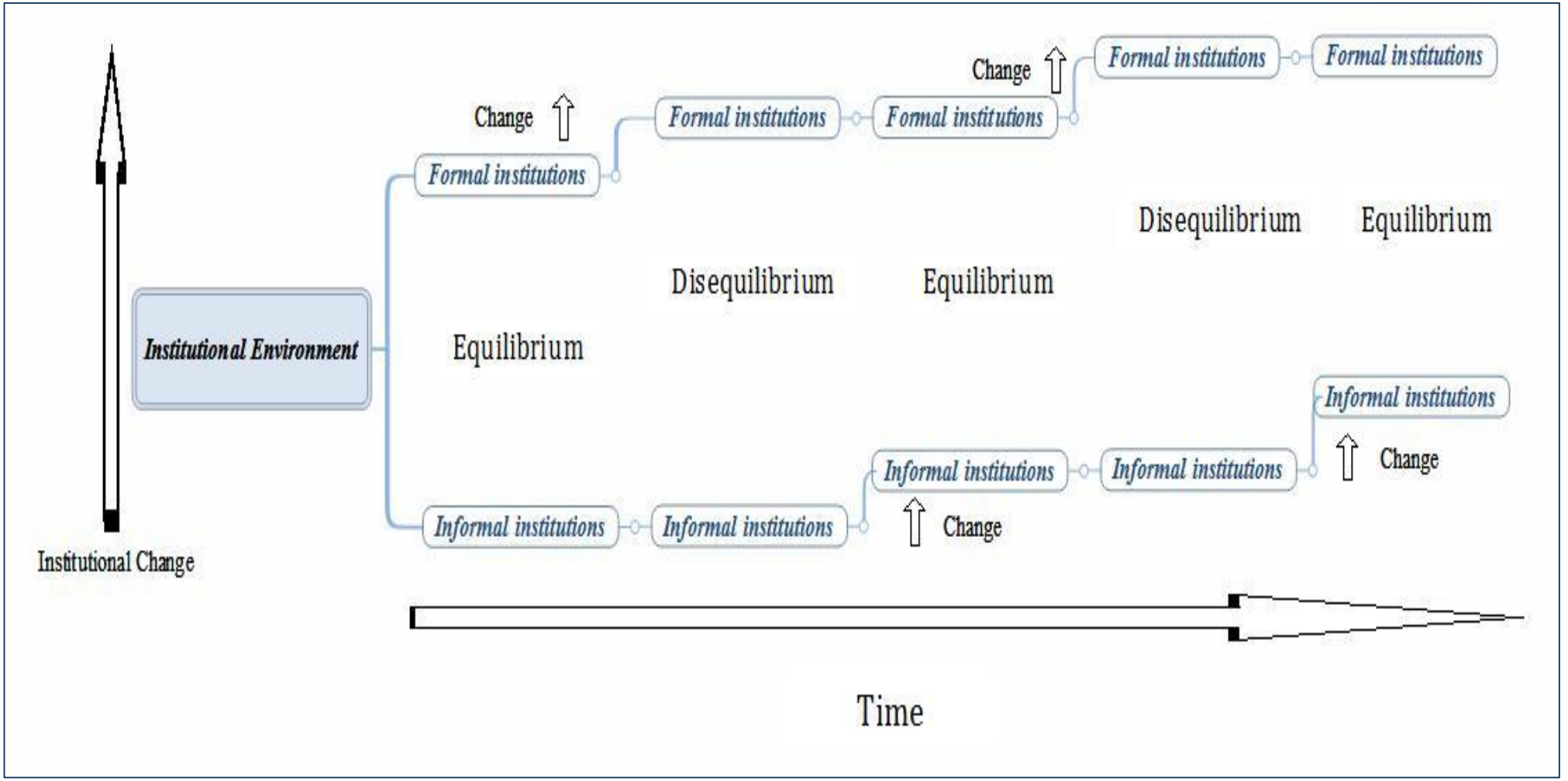


Diagram 4-3: Continuous institutional change model

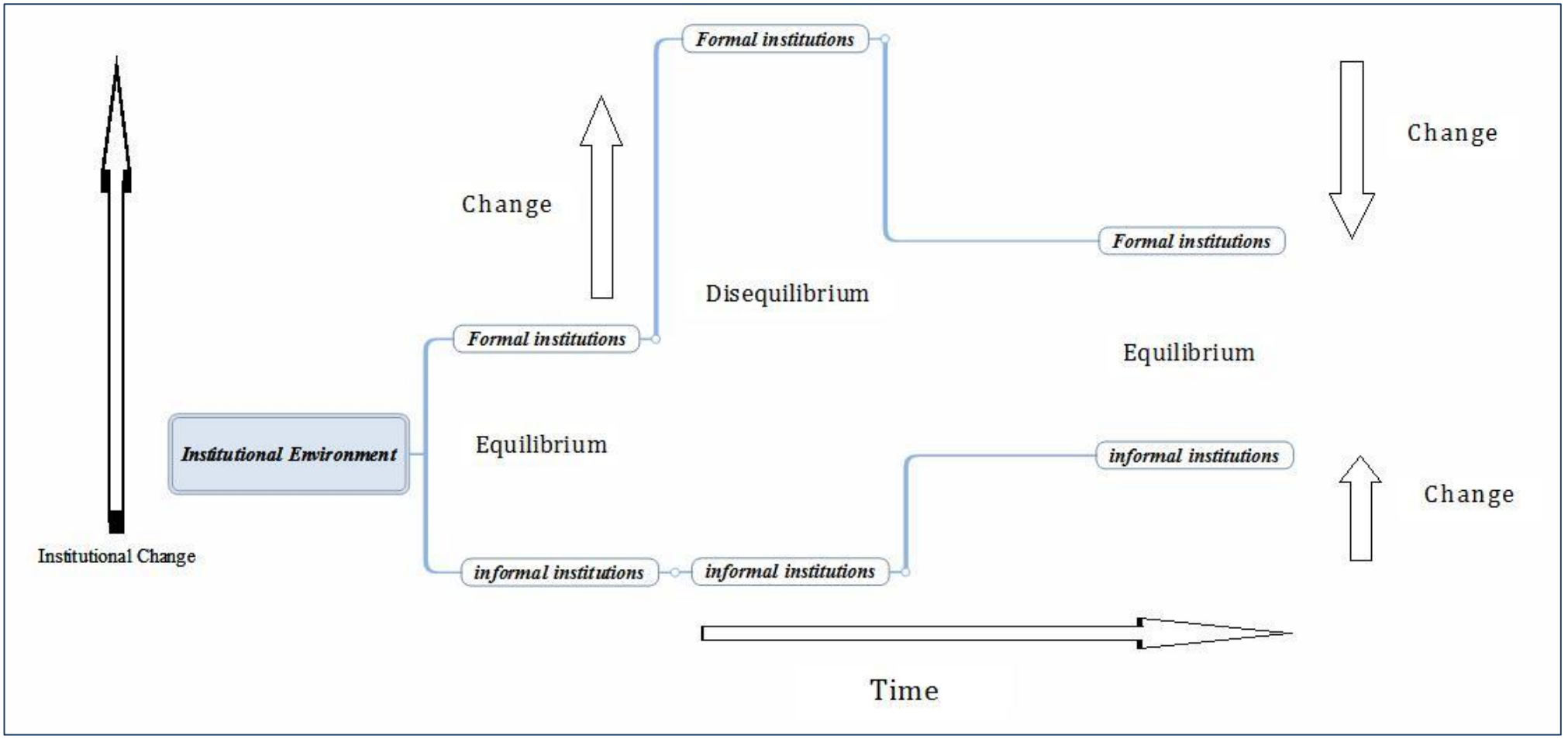


Diagram 4-4: Discontinuous institutional change model

2 Methodology

The objective of the thesis is to analyse how a group of beneficiaries of a common-pool resource (CPR) can organise and manage the resource to obtain sustained benefits. More specifically, this study will investigate the impact of the institutional context on the efforts of actors to organise to solve CPR problems. To address this issue, this research will be conducted through a case study of the Nile-related cooperation among the Nile Basin riparian countries from the beginning of the twentieth century until 2010. The study will focus on four riparian countries: Egypt, Sudan, Ethiopia and Uganda. These four countries are considered "the quartet of major stakeholders in the Nile Basin" (Waterbury, 2002, p. 5).

2.1 Research Hypothesis and Method

The hypothesis of this study is that, during the period studied, the informal institutions of the riparian countries have hindered the cooperation attempts from achieving their optimal outcomes. The research adopts a case-study design, with in-depth qualitative analysis. Nevertheless, the research will not rely on primary data collection and will resort to analysing empirical quantitative and qualitative material in published sources owing to practical constraints. The analysis begins by exploring the physical characteristics that affect the interaction among the riparian countries. Consequently, the study period will be divided into four phases due to the difference of power relations and the pattern of change in each of these phases, which have been referred above: colonial period, post-colonial period, early twenty-first century, and the present situation. Testing this hypothesis will be conducted by examining the following research questions:

1. What was the institutional framework at the beginning of each phase?

2. What were the institutional changes implemented in each phase of the study period and the resulting institutional framework by the end of the phase?

3. What were the main institutional impediments that account for the failure to

reach a feasible optimal institutional framework in each phase?

4. How did the Egyptian institutional environment influence the distribution of benefits of Nile water to the various segments of the Egyptian population in each phase?

Finally, the research attempts to draw the main necessary conditions and optimal dynamics of process of institutional change that can lead to a feasible optimal institutional framework for Nile water management in the future.

CHAPTER 5

PHYSICAL ENVIRONMENT OF THE NILE BASIN

This chapter provides a brief review of the main physical characteristics of the Nile Basin that affect its economic value as a common resource. The chapter is structured in five main sections. The first section reviews briefly some basic hydrological concepts that are relevant to the topic of the research. The second part provides an overview of the Nile Basin that shows its poor annual flow in comparison with similar river basins. Consequently, the impact of the topography of the basin on the river flow is summarised in the third section. The following section analyses the relation between the climate of the basin, the rainfall and the annual flow of the Nile. Finally, the water flow through the main tributaries of the Nile is mapped in the last section.

1 Basic Hydrological Concepts

This study focuses on the basic natural processes of water that provide benefits to people. Therefore, it is imperative to begin with a brief overview of the basic water concepts and processes in nature. The first basic fact about water, which has been indicated above, is that water is finite resource. This is because of the fact that the total amount of water on earth, which is termed the earth's water budget, does not change over time (Lerner & Lerner, 2005). Moreover, water is in constant motion in a closed system called the hydrological cycle (Lerner & Lerner, 2005). In general, the term hydrology is used to refer to the science that studies the existence, distribution and disposal of water on earth (Raghunath, 2006). Hydrological cycle refers the water transfer cycle that is composed of a number of processes by which water moves through the different parts of the earth (Newton, 2003). There are three main processes in this hydrological cycle: evaporation and evapotranspiration, precipitation and runoff (Newton, 2003). Evaporation is the process by which water is converted from a liquid to a gas. Water evaporates mainly in a constant way from oceans, lakes and rivers. Transpiration is a special form of evaporation in which water evaporates from the leaves and stems of plants. Both processes are summed together as evapotranspiration to refer to all forms of evaporation. Precipitation is

the transfer of water from the atmosphere to the earth's surface in different forms, such as rain, snow, sleet and hail. Finally, runoff is the movement of water from the land surface to the seas and oceans through rivers and lakes Runoff occurs when the amount of precipitation becomes greater than the ability of the land to absorb it (Lerner & Lerner, 2005).

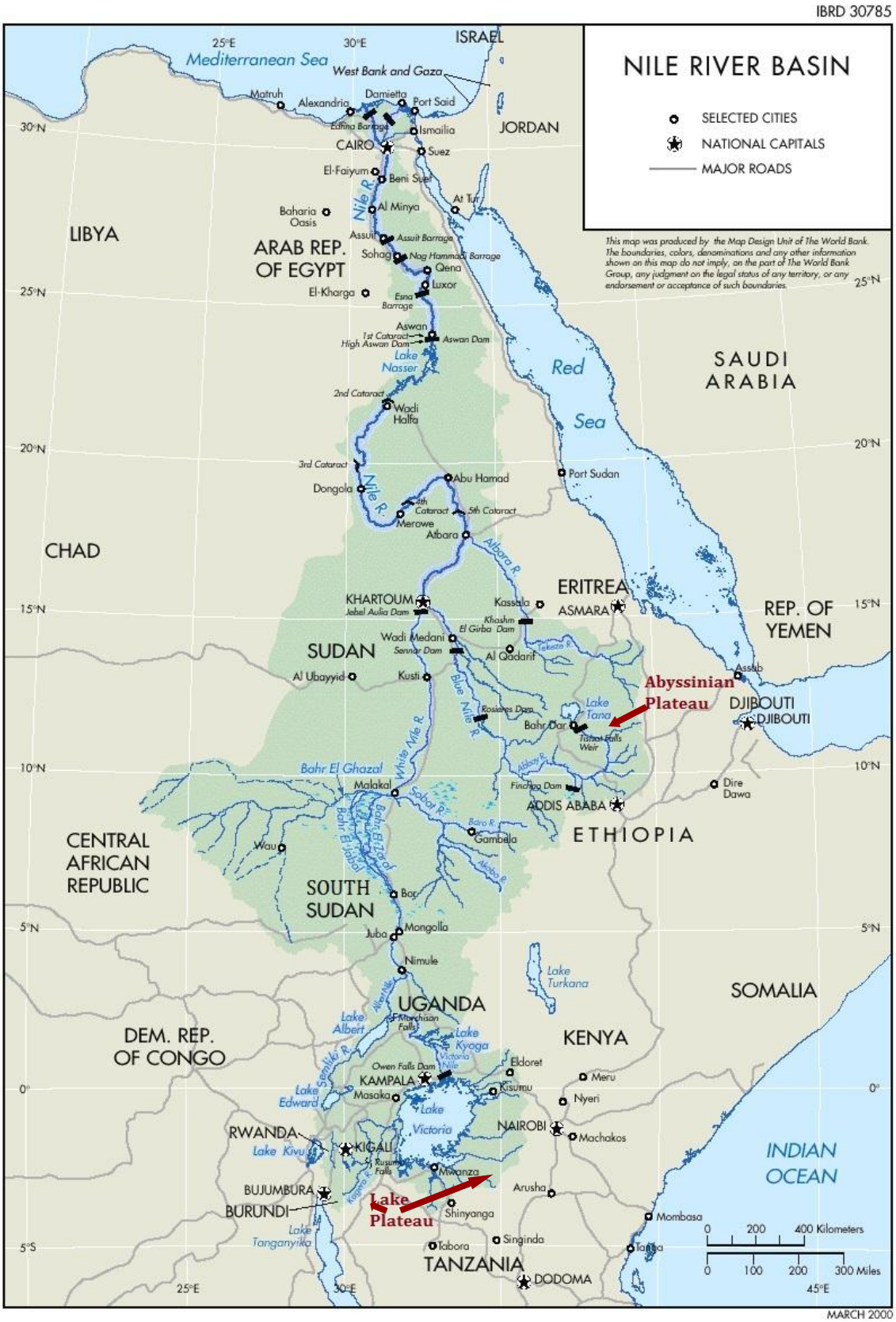
Since a more specific concern of this research is studying river water management, some basic river-related concepts require familiarity. In general, rivers are the bodies of flowing water that are driven by gravity (Lerner & Lerner, 2005). The rills, brooks and rivers that flow into a major river are referred to as tributaries (Newton, 2003). River system is a technical term that is used to refer to a main river and its whole network of headwater and tributaries (Lerner & Lerner, 2005). The land area that drains water into a river is called watershed, catchment area or drainage basin (Lerner & Lerner, 2005). River water is usually measured in two forms: volume (stock) or flow rate. In this study, the river water stock is expressed in cubic metres whereas the river flow is expressed in cubic metres per unit of time. Precipitation is measured using a fixed-size rain gauge and expressed as a vertical depth or height of water in millimetres. This height can be converted into volume, expressed in cubic metres, by multiplying it by the surface area of the recipient territory.

2 Overview of the Nile Basin

The River Nile is the longest river in the world with a length of about 6695 kilometres and its drainage basin, shown in Map 6-1, covers a surface area of about 3,112,000 square kilometres (Nile Basin Initiative, 2014). This area of the Nile Basin is approximately one-tenth of the total surface area of the African continent (Shahin, 1985). The basin extends over a very wide band of latitude, from 4° South to 32° North, and over a comparatively narrow band of longitude, from about 21° 30' East to 40° 30' East (Sutcliffe & Parks, 1999; Shahin, 1985). The river course and its tributaries traverse the territories of Burundi, Rwanda, Tanzania, Kenya, Uganda, The Democratic Republic of Congo (DCR), Ethiopia, Eritrea, Sudan and Egypt. Recently, South Sudan has become an independent state (in 2011) and joined the Nile riparian countries.

Country	Country Area (km^2)	Area within the Nile Basin (km^2)	Percentage of the total Nile Basin Area	Percentage of the country in the Nile Basin
Burundi	27,835	13,260	0.4	47.6
DR Congo	2,345,410	22,143	0.7	0.9
Egypt	1,001,450	326,751	10.5	32.6
Eritrea	121,320	24,921	0.8	20.5
Ethiopia	1,127,127	365,117	11.7	32.4
Kenya	582,650	46,229	1.5	7.9
Rwanda	26,340	19,876	0.7	75.5
Sudan	2,505,810	1,978,506	63.6	79.0
Tanzania	945,090	84,200	2.7	8.9
Uganda	236,040	231,366	7.4	98.0
Total	8,919,072	3,112,369	100.0	34.9

Table 5-1: Nile Basin: repartition among riparian countries (Shahin, 1985).



Map 5-1: Nile River Basin (World Bank, 2014)

Despite the long length of the river and the huge size of its basin, the total flow of the Nile is relatively small. This fact can be revealed by comparing its specific discharge (q) with that of the other large rivers. Specific discharge is calculated using the relationship q=Q/A where Q is the long-term mean discharge and A is the surface area of the river catchment area (Shahin, 1985). The River Nile has the lowest specific discharge among all the large world rivers with drainage basin areas (Table 5-2). Moreover, the specific discharge of the Nile is just one-tenth the specific discharge of the river geographically closest to the Nile, which is the Congo River (Shahin, 1985).

River	Site	Catchment Area, A, Km^2	long-term discharge, Q, (m^3/ sec)	Specific discharge, q, (m^3/ sec / Km^2)
Nile	Aswan	2,880, 000	2,830	0.98
Missouri	Hermann	1,369 , 000	2,187	1.69
Mississippi	St. Louis	1,817,000	4,900	2.70
Amur	Khabarovsk	1,620,000	7,300	4.51
Ob	Salekhard	2,450,000	12,460	5.09
Volga	Kuibyshev	1,220,000	7,480	6.13
Lena	Kyusyur	2,430 , 000	15,900	6.54
Yenisei	Ingarka	2,470,000	18,100	7.33
Congo	River mouth	3,700,000	36,000	9.73
Yangtze	Hankow	1,490,000	23,700	15.91

Table 5-2: Specific discharges of large rivers (Shahin, 1985).

The small size of the total flow is caused by the fact that the areas which contribute significantly to the Nile flow are relatively small and isolated (Sutcliffe & Parks, 1999). Only two regions can considered as the major sources of the Nile: the East African lake region and the Ethiopian highlands. On the contrary, two-fifths of the basin area is arid and hyper-arid land that contributes little or no runoff to the

river (Nile Basin Initiative, 2014). However, it should be noted that the runoff that feeds the Nile River constitutes a very small proportion of total rainfall in the basin. Although the total annual rainfall on the basin reaches nearly 1650 billion cubic metres on average, the annual flow of the Nile at Aswan is around 84 billion cubic metres. In other words, the annual flow of the Nile that reaches Egypt to be shared with Sudan is less than 5% of the total water that falls as rain on the basin (Johnston, 2012; Nile Basin Initiative, 2014). The low volume of runoff relative to rainfall can be traced to two main causative factors: topography and climate (Shahin, 1985).

3 Topography

In general, the topography of a river basin dictates the water flow within that basin (Demissie, et al., 2012). The Nile Basin is characterised by two mountainous plateaus with peaks rising some thousands of metres above mean sea level (Shahin, 1985). The first is the Ethiopian or Abyssinian Plateau (Map 5-1), which occupies the eastern part of the basin with peaks rising to more than 3500 metres above mean sea level (Shahin, 1985). The second is the Lake Plateau (Map 5-1), which is in the south eastern part of the Nile Basin and rises to between 1000 and 2000 metres above mean sea level (Shahin, 1985). However, this plateau has the two highest mountain ranges in the basin: first, the Ruwenzori mountain range extending between Lakes Edward and Albert at the west of the Lake Plateau has a peak rising more than 5100 metres above mean sea level; and second, the Mt Elgon range which has a peak of 4300 metres above mean sea level at the north east of Lake Victoria (Shahin, 1985).

The upstream parts of the Nile Basin are characterised by a ridged topography with steep slopes whereas the central and downstream regions are mainly flat lands (Demissie, et al., 2012). Moreover, the basin descends gradually north to the lake plateau towards Sudan and Egypt where the Nile flows at altitudes lower than 500 metres (Shahin, 1985). Therefore, the highest point in the basin is at the Lake Plateau in the southern part of the basin, which is the top of the Ruwenzori Range with an altitude 5120 metres above mean sea level as mentioned above, whereas the lowest point of the basin is located in Egypt, which is the trough of the

El-Quattara depression at about 160 metres below mean sea level (Shahin, 1985).

4 Climate and Rainfall

The climate system is one of the major sources and sinks of water for river basins as it supplies the river basin with precipitation while taking away water in the form of evapotranspiration (Demissie, et al., 2012). The climate of the Nile Basin is extremely variable because of the expanse of the surface area of the basin across 36 degrees of latitude (Sutcliffe & Parks, 1999). The climate of the Nile Basin is divided into three climatic zones: arid, temperate and tropical (Demissie, et al., 2012). The northern third of the basin is classified as hyper-arid while the southern half of the basin is semi-arid to humid (Johnston, 2012).

This variance in climate is reflected on the river runoff. Although the basin spreads over 11 countries, the regions that mainly contribute to the river flow are two small and isolated regions (Sutcliffe & Parks, 1999). The first is the East African lake region, which receives high rainfall distributed between two rainfall seasons. The second is the Ethiopian highlands, which receives high rainfall within only one season. However, its steep topography gives rise to a relatively high and temporally concentrated runoff (Sutcliffe & Parks, 1999). Mean annual precipitation (MAP) declines as the river moves from the southern and eastern highlands to the lowland deserts in the north. The MAP ranges from more than 2000 millimetres in Uganda around Lake Victoria and in the Ethiopian highlands to almost zero millimetres in most of Egypt, as shown in Table 5-3. Moreover, the table shows that Sudan receives annually a great volume precipitation that exceeds 1600 millimetres in some regions of the country. However, there is a great variance in the rainfall among the different regions in Sudan. As the table shows, precipitation falls to a zero level in some areas in Sudan. On the other hand, Uganda, Tanzania and Kenya also receive a significant amount of annual precipitation, exceeding on average 1000 millimetres, with the exception of Kenya that receives annually around 600 millimetres in average.

Country	Average rainfall in Nile Basin: minimum (mm/year)	Average rainfall in Nile Basin: maximum (mm/year)	Average annual precipitation (mm/year)
Burundi	895	1,570	1,274
DR Congo	875	1,915	1,543
Egypt	0	120	51
Eritrea	540	665	384
Ethiopia	205	2,010	848
Kenya	505	1,790	630
Rwanda	840	1,935	1,212
Sudan	0	1,610	416
Tanzania	625	1,630	1,071
Uganda	395	2060	1,180

Table 5-3: Average annual precipitation and rainfall (Karyabwite, 2000; FAO, 2005).

Moreover, the great extremes in average annual precipitation and evapotranspiration divide the riparian countries into net users of water and net contributors to the water budget, with extremes at both ends of the continuum (UNEP, 2010). The difference between mean annual precipitation (MAP) and potential evapotranspiration (PET) in the Nile Basin shows that most regions of the basin, especially the central and downstream regions, are water-deficit regions (Demissie, et al., 2012). With the exception of the main water sources in the equatorial and Ethiopian Highlands, evaporation exceeds rainfall over most of the Nile Basin especially in central and northern Sudan, where summer temperatures sometimes rise above 45 °C (Johnston, 2012). Ethiopia receives only 22% of the basin's total rainfall but the low evapotranspiration caused by relatively low temperatures and humidity in the highlands allows much of that water to run off.

Thus, Ethiopia contributes well over half of the Nile's total water budget (UNEP, 2010). Rwanda, Burundi, Uganda, Tanzania and Kenya also contribute significant runoff to the Nile, but much of this water is lost in southern Sudan before it reaches Khartoum.

Country	Internal Renewable Water Resources (IRWR) (million m^3/year)	Actual Renewable Water Resources (ARWR) (million m^3/year)	Dependency ratio %	IRWR per capita in 2012 (m3/ person)	ARWR per capita in 2012 (m3/person)	ARWR per capita in 2037 (m3/person)
Burundi	10.1	15.5	34.8	1161	1782	1233
DR Congo	900	1283	29.9	12931	18434	14337
Egypt	1.8	58.3	96.9	21	695	534
Eritrea	2.8	6.3	55.6	500	1125	916
Ethiopia	122	122	0.0	1410	1410	974
Kenya	20.7	30.7	32.6	485	719	577
Rwanda	9.5	9.5	0.0	841	841	361
Sudan	30	64.5	53.5	831	1787	1279
Tanzania	84	93	9.7	1761	1950	1413
Uganda	39	66.0	40.9	1096	1854	1335

Table 5-4: Renewable water resource in the Nile Basin

(FAO, 2005; NBI, 2012; Abtew, 2014).

Moreover, high dependence on water for irrigation and high evapotranspiration make Egypt a net user of water coming from the upstream countries which it needs to survive (UNEP, 2010). Egypt's ratio of dependency on the Nile water resources reaches around 97%. Similarly, although Sudan receives rainfall equal to around 46.5% of the river runoff, high temperatures, intensive

irrigation and water loss in its territories mean that it is also a net user of external water resources with a dependency ratio of around 53.5%. On the other hand, both Ethiopia and Burundi have full water independence, with a dependency ratio of approximately zero. Similarly, Tanzania has a dependency ratio less than 10% while Congo, Uganda and Kenya come in the middle with dependency ratios between 30% and 40% respectively.

5 Main Tributaries and Sub-basins

Map 5-2: Nile River – Main tributaries and sub-basins (NBI, 2012)

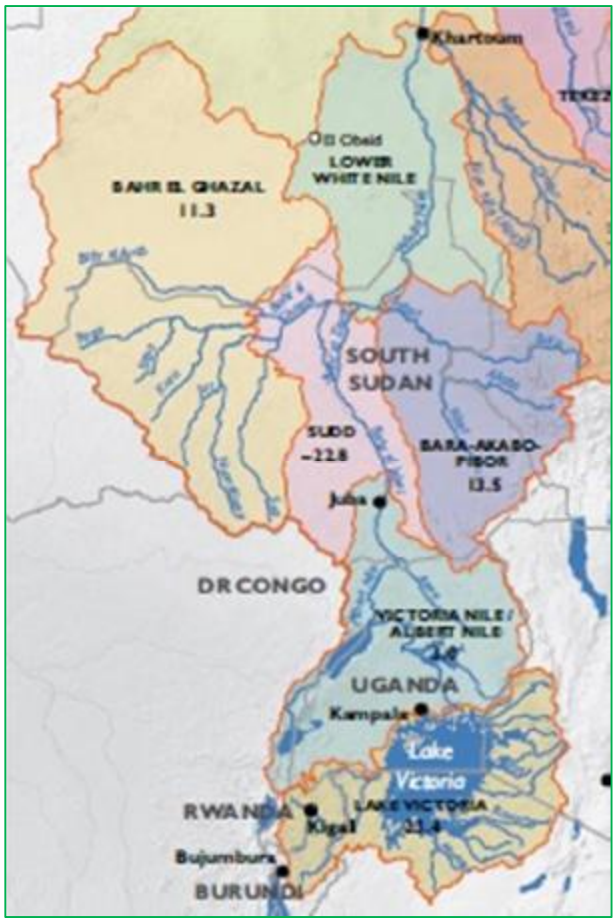
The Nile can be divided into five main sub-basins (Map 5-2): the White Nile sub-basin: the Sobat-Baro-Akobo sub-basin; the Blue Nile (Abbay) sub-basin; the Atbara-Tekeze sub-basin and the Main Nile system (Johnston, 2012). The White Nile sub-basin comprises three parts: headwaters, middle reaches and the Lower White Nile. The headwaters are the highlands of the Equatorial Lakes Region including Lake Victoria. The middle reaches are located in western and southern Sudan. In this part, the river runs through the swamps of the Sudd (Bahr el Jebel) and Bahr el

Ghazal. Finally, the Lower White Nile starts in central Sudan south of Khartoum. The Sobat-Baro-Akobo sub-basin comprises the highlands of southern Ethiopia as well as the Machar marshes and the lowlands of south-eastern Sudan. The Blue Nile sub-basin includes the central Ethiopian plateau and Lake Tana as well as the lowlands of western Ethiopia and eastern Sudan. The Atbara-Tekeze sub-basin includes the highlands of northern Ethiopia and southern Eritrea and the arid lands of north-eastern Sudan. Finally, the Main Nile system is composed of two distinct sections: the main Nile in Sudan above the Aswan and the Egyptian Nile below Aswan.

5.1 The White Nile

The White Nile starts with a number of tributaries of Lake Victoria (Map 5-3). The furthest tributary of the lake and the Nile in general is the River Kagera which originates from the mountains of Burundi and Rwanda (Sutcliffe & Parks, 1999). It runs through a series of lakes and swamps to flow into Lake Victoria (Sutcliffe & Parks, 1999). Other smaller water courses that drain the plains to the southeast of the lake and the swamps of Uganda to the northwest also flow into the lake (Sutcliffe & Parks, 1999).

The outflow from Lake Victoria (Map 5-3) runs into a single channel, a tributary of the Kafu-Kyoga, flowing through several shallow falls northwest towards Lake Kyoga to the north of Lake Victoria (Sutcliffe & Parks, 1999). Lake Kyoga is essentially a grass-filled valley which sometimes cause a net loss of river flow and sometimes provides a net gain (Sutcliffe & Parks, 1999). After leaving Lake Kyoga the river runs through a shallow wetland to the Murchison Falls, then turns east to Lake Albert (UNEP, 2010). The lake also receives another inflow from the Semliki River, which drains Lake Edward and the Ruwenzori mountains (UNEP, 2010).



Map 5-3: White Nile sub-basin (NBI, 2012)

The Albert Nile or Bahr el Jebel leaves Lake Albert at its northern end and runs northeast where the river crosses Sudan border (Map 5-3) in a flat reach flanked by swamp vegetation (Sutcliffe & Parks, 1999). Flowing north across the Uganda-Sudan border, the river splits into two channels – the Bahr al-Jabal and the Bahr al-Zaraf. Flowing across broad flat plains, the rivers expand into a vast wetland, the Sudd swamps. Covering around 8000 square kilometres during the dry season, the swamp seasonally overflows, flooding an area many times this size (UNEP, 2010). Within the Sudd, the water flows out from the main channel into swamps. Evaporation from these swamps greatly exceeds rainfall and therefore the outflow from the swamp is only around half the inflow (Sutcliffe & Parks, 1999). At Lake No, the Bahr el Jebel turns east to become the White Nile, while the Bahr el-Ghazal joins the lake from the west. The Bahr el-Ghazal basin is relatively large and has a high rainfall. However, the various tributaries of the Bahr el-Ghazal flow into swamps and therefore almost no flow reaches the White Nile (Sutcliffe & Parks, 1999). Finally, the

White Nile is joined from the east by the Sobat near Malakal.

5.2 Sobat Basin

The Sobat flows, as depicted by Map 5-4, to the White Nile from the confluence of its two major tributaries: the Baro and the Pibor which drain the south-western part of the Ethiopian highlands (Sutcliffe & Parks, 1999). The Pibor also receives occasional high runoff from South Sudan. The flow of the White Nile from the mouth of the Sobat until it reaches its confluence with the Blue Nile is relatively quiet (Sutcliffe & Parks, 1999). The river only receives significant inflow in the Machar marshes in rainfall seasons of exceptional conditions. Consequently, it continues flowing north for 500 kilometres until it meets the Blue Nile at Khartoum (UNEP, 2010).

Map 5-4: Sobat river sub-basin (Maps of World, 2013)

5.3 Blue Nile Basin

The Abbay, or Blue Nile, sub-basin covers an area of 311,548 square kilometres (Awulachew, et al., 2011). The bulk of the flow into the main Nile at Khartoum is supplied by the Blue Nile (Sutcliffe & Parks, 1999). More specifically, the Blue Nile Basin contributes 62% of the annual average flow reaching Aswan. When combined with the Tekezze and Baro-Akobo rivers, which feed the Sobat River,

the total contribution of Ethiopia to the flow of the Nile at Aswan is 86% (World Bank, 2006). The Blue Nile drains mainly the western Ethiopian highlands, with a relatively small portion of its water stored in Lake Tana (Sutcliffe & Parks, 1999). The confluence of the Blue Nile and the White Nile is at Khartoum.

Within the basin, precipitation varies significantly with altitude. The volume of rainfall is considerably greater in the Ethiopian highlands than on the flat areas of Sudan (Awulachew, et al., 2011). The mean annual flow of the Blue Nile at Sudan-Ethiopia border is around 50 billion cubic metres (Awulachew, et al., 2011). However, the mean annual flow of the Blue Nile at Khartoum is 48.2 billion cubic metres, which is slightly less than at the border despite inflows from the Sobat River (Awulachew, et al., 2011). Water storage in this sub basin is difficult because of the rugged topography of the basin and the consequent problems of erosion and potential sedimentation (Sutcliffe & Parks, 1999).

Map 5-5: Blue Nile sub-basin (ENTRO, 2014a)

5.4 Atbara–Tekeze sub-basin

The main Nile below Khartoum flows north a further 325 kilometres to be joined by its last tributary, the Atbara. The Atbara drains the northern portion of the Ethiopian highlands and a part of Eritrea (Sutcliffe & Parks, 1999).

Map 5-6: Atbara–Tekeze sub-basin (ENTRO, 2014b)

5.5 Main Nile

Map 5-7: Main Nile sub-basin (ENTRO, 2014c)

Below the Atbara mouth, the river runs through an arid area that has successive cataracts (Sutcliffe & Parks, 1999). The river flow is reduced by evaporation and irrigation withdrawals. The Nile enters Egypt after Wadi Halfa (Sutcliffe & Parks, 1999). At about 200 kilometres south of the southern frontier of Egypt, the river channel sits in a narrow trough (Shahin, 1985). In general, the width of this trough increases as the river proceeds northwards. Almost 200 kilometres before discharging into the sea, the river bifurcates into two branches, which encompass the Nile Delta, then both branches run into the Mediterranean Sea (Shahin, 1985).

Finally, it can be deduced from the above analysis of the Nile flow that the volume of water that reaches its upstream countries is affected negatively by the evapotranspiration and the water loss in the Sudd swamp region in South Sudan. The White Nile loses around 30% of its water in the Sudd swamps between Mongalla and Malakal (Karyabwite, 2000). Moreover, although Sudan receives a significant amount of annual precipitation the river runoff does not increase in Sudan but experiences a slight decline.

CHAPTER 6

COLONIAL PERIOD: 1882–1954

This chapter analyses the strategic interactions among the riparian countries during the colonial period. The colonisation and decolonisation of riparian countries occurred at different times. However, since Egypt represents the focal point of the study the colonial period of Egypt from 1882 to 1954 has been chosen as the time framework of this period. The chapter begins by mapping the institutional structure of the Nile Basin at the beginning of this period. Consequently, the strategic interactions among the selected riparian countries are analysed. The final section will draw conclusions and present some remarks.

1 Institutional Structure: Year 1882

As indicated in the analytical framework, the analysis uses Ostrom's model to examine the layers of the institutional structure of the Nile Basin. Therefore, this section begins by analysing the conditions of the physical environment of the Nile Basin, which represents the first layer of this structure. Moreover, it will briefly relate these conditions to the actions of riparian parties during this period. Secondly, it examines the institutional environment of the Nile Basin. Finally, this part will study the interaction between the conditions of the physical environment of the basin and its institutional environment to assess their impact on the allocation of the water of the Nile Basin.

1.1 Conditions of Physical Environment of Nile Basin

The physical conditions of the Nile during this historical period have been among the catalysts of the efforts of the riparian countries to regulate the waters of the Nile, both legally and technologically. This historical period can be divided into two sub-periods according to the annual discharge of the Nile. The first period starts from 1870, before the beginning of the studied historical period, and extends in 1898 (Al-Kadi, et al., 1987). The second period covers the first half of the twentieth century (Al-Kadi, et al., 1987).

The first sub-period is characterised by high annual discharges of the Nile measured by the Nilometers in Egypt. The average annual discharge during this sub-period was 109,775 billion cubic metres (Diagram 7-1). Moreover, the annual discharges of the Nile were above 100 billion cubic metres in most of the years of this sub-period. The highest annual discharge of the Nile was recorded in 1879 as a result of the flood in the rainy season 1878/9. The discharge of this rainy season reached 150.3 billion cubic metres, which is the highest annual discharge of the Nile ever recorded (Al-Kadi, et al., 1987). This flood caused widespread loss of life and significant damage to the agriculture sector. Moreover, the least recorded annual discharge was around 80 billion cubic metres which is very close to the present average annual discharge of the Nile. Furthermore, all other the annual discharges of the Nile during this period were highly above the present average of the river.

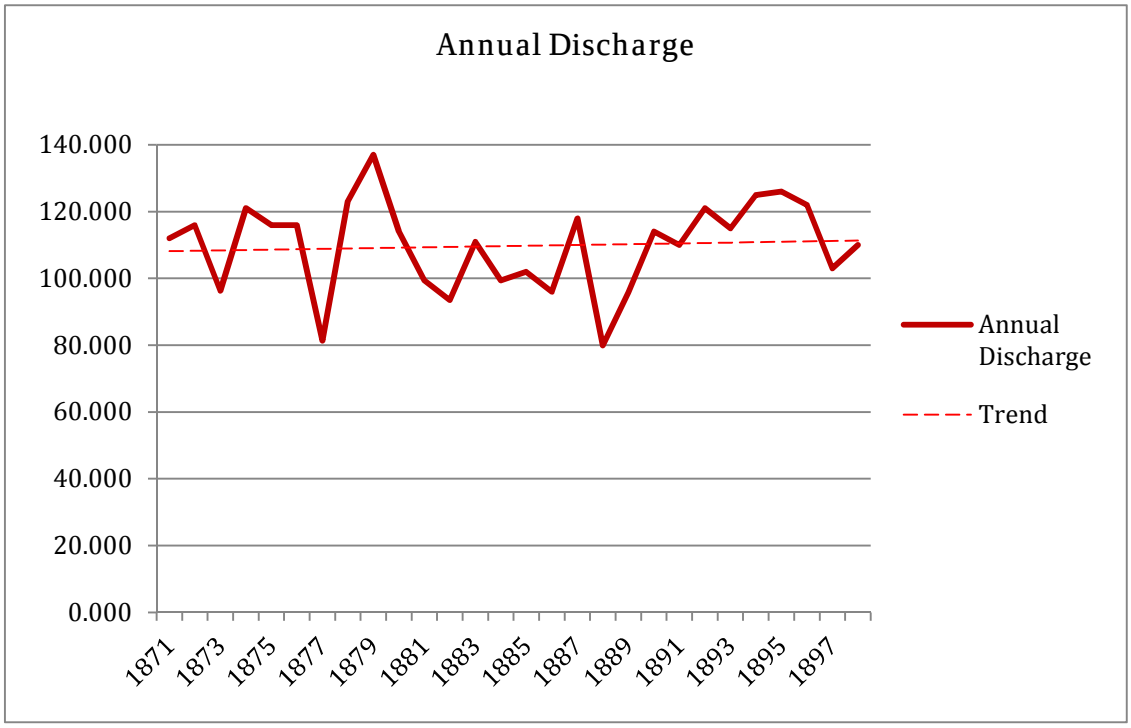


Diagram 6-1: Annual discharge of the Nile in billion m^3 during 1871–1898

(Hurst, et al., 1946)

The second sub-period is characterised by low annual discharges of the Nile with the exception of a few years. The recorded annual discharges were lower than 100 billion cubic metres during most of these years with exception of only five years. In contrast to the previous sub-period, the average annual discharge during this period was 82.6 billion cubic metres. Moreover, the discharge in 1913 declined to 45.5 billion cubic metres, one of the lowest annual discharges of the Nile recorded in modern history.

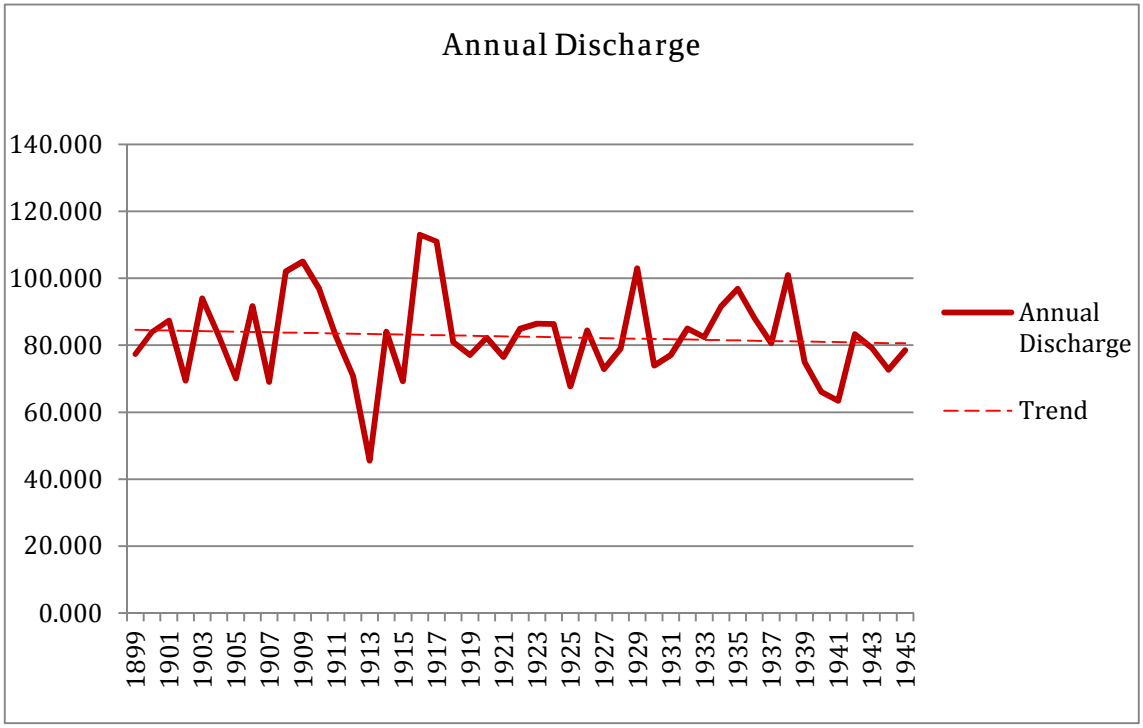


Diagram 6-2: Annual discharge of the Nile in billion m^3 during 1899–1945

(Hurst, et al., 1946)

Therefore, it can be concluded that the Nile witnessed two trends of annual flow during this period. It experienced high annual runoffs during the period to 1898. Consequently, it suffered from low annual flow during the period from 1899 to 1945. Egypt was the country that was most affected by this decline in the Nile flow. This decline is the most significant aspect of the physical environment during the period (Diagram 6-2).

The decline in the annual discharge of the Nile from the beginning of the twentieth century was among the factors that have induced Egypt, as the main user of the river, to concentrate its efforts to guarantee, increase if possible, its annual supply of water. These efforts have taken two forms: technical and diplomatic. The technical efforts have aimed at establishing reservoirs and dams in Egypt and in other Nile riparian countries to ameliorate the negative impacts of flood and drought periods on the Egyptian population in general and on the Egyptian agriculture sector in particular. Since these technical efforts have been regarded as insufficient to achieve this objective, Egypt intensified its diplomatic efforts for the same purpose. Egypt and the United Kingdom, its colonising power, have worked together to establish a legal framework that guarantees the annual water requirements of Egypt. This framework has taken the form of binding bilateral agreements with other riparian countries.

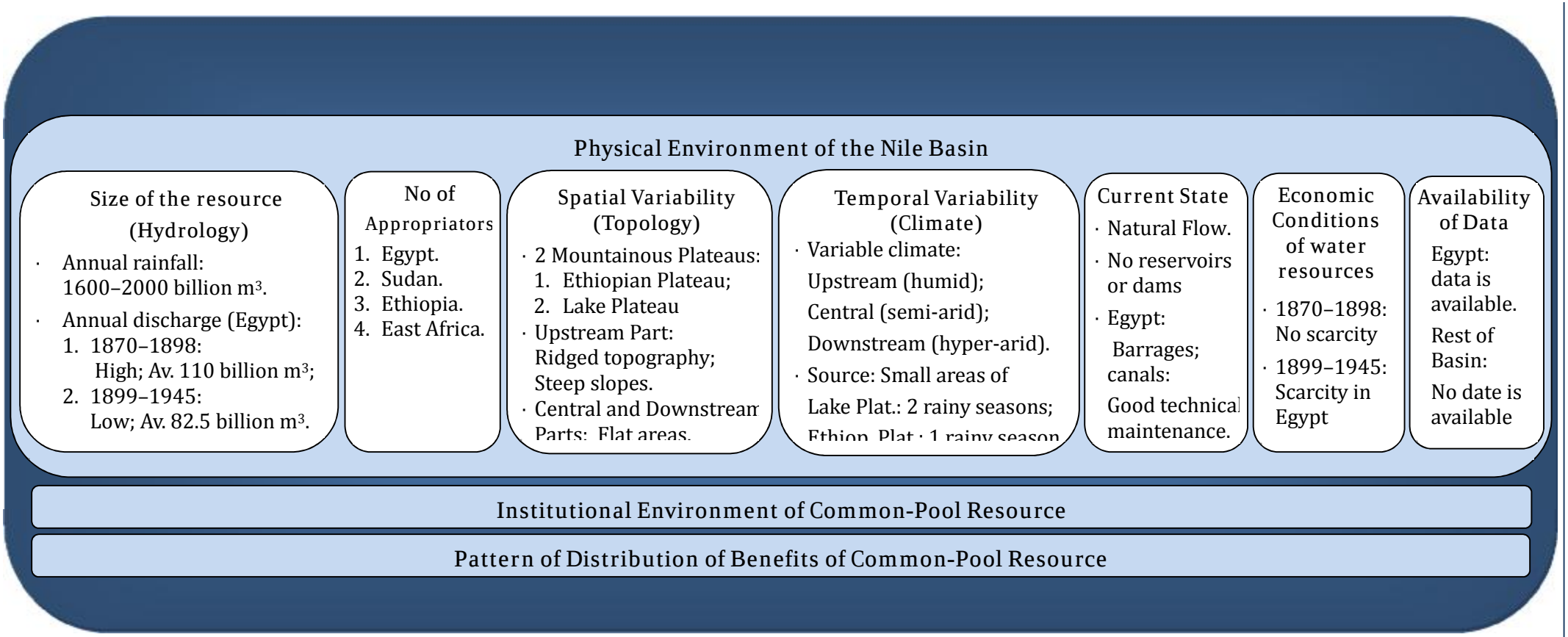


Diagram 6-3: Institutional structure of the Nile Basin – Physical Environment

1.2 Institutional Environment of the Nile Basin

This section will examine the institutional environment of the Nile Basin at the beginning of the colonial period. It will briefly analyse the historical relations between Egypt and the other studied riparian countries in order to identify the main informal institutions that constrained these relations concerning the Nile. It will also explore how these informal institutions interacted with the relations between Egypt and the studied countries. Consequently, it will explore the main formal institutions existing during this period and evaluate their impact on the relations between the riparian states.

1.2.1 Informal Institutions

A full analysis of the informal institutions of the Egyptian nation and those of the other three riparian countries is beyond the scope of this study. However, this section will explore briefly the main informal institutions that influenced relations between Egypt and Sudan, Ethiopia, and Uganda concerning the Nile. First, the Nile-related informal institutions in Egypt will be examined. Consequently, the second part will analyse the informal institutions that have characterised the relations between Egypt and the other three riparian countries: Sudan; Ethiopia, and Uganda concerning the Nile. Since the relations between Egypt and Ethiopia are the most complicated among the riparian countries, a more detailed analysis will be dedicated to these two countries.

1.2.1.1 Egypt

The Nile and religion have played major inter-related roles in the evolution of Egyptian society. Egyptians have recognised from their early history that they owe their civilisation to the River Nile. However, they also believe that they own this river. The Nile has played an important role not only in the development of the Egyptian state but also in the evolution of Egyptians' religious beliefs. Religion has been a major determinant in the definition of Egyptians' identity and in their perception of

other nations.

The centrality of the role of the Nile to Egypt has been one of the most distinctive characteristics of Egyptian history and culture. The evolution of the sophisticated ancient Egyptian civilisation with its unique dependence on that river coming from an unknown source led Greek philosophers to believe that its floods had been released by the winds that created the world (Evans, 1994). Around 10,000 years ago, the River Nile started to transfer silts from its sources in Ethiopian highland and equatorial lakes to form the agricultural layer of the land of Egypt (Said, 1994). Egyptians started their first agricultural activity in about 5200 BC by sowing seeds on the ground and leaving the task of watering and land fertilisation to the natural floods (Chesworth, 1994). Therefore, Egyptian society was characterised from the beginning by the dependency of Egyptians on river water instead of rainfall (Hamdan, 1967). However, the Nile with its fluctuating behaviour forced the Egyptians to invent certain agricultural techniques (Moret, 1927). Artificial-irrigation-based agriculture, including organised flooding and draining by sluice gates and water dikes, was established by the first Pharaonic Dynasty around 3100 BC (Chesworth, 1994). This pattern of agricultural activity induced the establishment of the oldest technocratic government and the oldest state in the history of humanity (Assmann, 2002). This government played the role of mediator between the people and the environment within a defined bounded territory (Hamdan, 1967).

The heavy dependence of the ancient Egyptian civilisation on the Nile floods is reflected in the correlation that has been revealed by modern research between sequences of high and low floods of the Nile and rises and falls of Egyptian dynasties (Evans, 1994). This close link between the state of the Nile and that of their civilisation enshrined in Egyptian minds a belief that the Nile is the source of their lives. Such dependence was noted by the Greek historian Herodotus in the fifth century BCE when he claimed that Egypt is “land acquired by the Egyptians and a gift of the river” (Griffiths, 1966, p. 57). No other riparian nation has relied on the Nile in its development. Therefore, Egyptians never confronted competition from any other riparian countries throughout their history. Therefore, they came to

believe that they have a historic right to the Nile water. It can be seen that this concept of historic rights is "a concept as ancient as Egypt itself" (Erlich, 2002, p. 6). Thus, Egypt's historic right to the Nile water has been one of the main Nile-related informal institutions of Egyptian society.

The crucial importance of the Nile in the life of Egyptians has been reflected in their religious beliefs since the early stages of the evolution of ancient Egyptian society. The ancient Egyptians considered the Nile a deific force of the universe and likened its annual fall and rise to that of the sun as both were equally important to their lives (Angelakis & Mays, 2012). Moreover, the fall and rise of the river is believed to be the reason that Egyptians were the first society to believe in resurrection after death. They likened the fall and the rise of the Nile flood waters to the "death" of the land that would be followed each year by the rebirth of the crops (Fay, 1991). Therefore, they believed that resurrection to life was a universal natural sequence to death (Fay, 1991). Therefore, the deities of holy triangle of Pharaonic Egypt, Osiris, Isis and Horus, were closely connected with the Nile (Collins, 2002). Osiris was drowned in the Nile water, but his resurrection was the beginning of the annual flood of the Nile, securing the renewal of life. Mourning her husband Osiris, Isis, the mother of Egyptians, shed her tears into the Nile, raising the level of its water and assuring the rebirth of crops. The Nile itself was depicted as a god, Hapi, who was considered as the personification of the fertility of the Nile. This founding myth of Egyptian culture reflects the Egyptian belief that the Nile is the source of their life. Therefore, ancient Egyptians built their temples aligned with course of the Nile (Assmann, 2002). Moreover, they marked their celebrations and commemorations of its flood in statues and hieroglyphic inscriptions in their temples. A sample of this religious literature is a hymn engraved in one of the small pyramids built by the VIth dynasty. This hymn described the moment of beginning of Nile floods as follows:

> *They tremble, they who see Hapi (the Nile) when he beats (his waves); but the meadows smile, the Banks blossom, the offerings of the gods come down (from the heavens); men do homage, the hearts of the gods are lifted up.*
>
> (Moret, 1927, p. 30).

Even after the Pharaonic Dynastic period, Egyptians recognised the crucial role of the Nile throughout their history. The annual celebration of the rise of the Nile on 17 June marks the crucial importance of the Nile to Egypt. For Christian Egypt, it marked the day when an archangel prayed to God to raise the Nile water (Collins, 2002). The Muslim version of the story claimed that the second Muslim Caliph, Umar ibn Al-Khattab, sent a card to the Nile asking it to rise by the will of God. Once this card was thrown by the ruler of Egypt into the middle of the river, the Nile started to rise in the following day. Therefore, successive Muslim rulers of Egypt used to send the heralds of the Nile through the streets starting from 17 June to announce the daily rise of the Nile (Collins, 2002). Therefore, it can be argued that the belief of the Egyptians that the Nile is the source of their life has been one of their oldest informal institutions.

Equally important, if the Nile has been one of the main pillars of the Egyptian society, religion has been also one of its main building blocks. In ancient Egypt, the monarchical exercise of power has been interpreted as a form of divine rule by proxy (Assmann, 2002). However, since Egypt was a territorial state isolated from its neighbour empires for the most of its ancient history, religion did not define Egyptians' identity in relation to other nations. In other words, religion was not a source of confrontation between Egyptians and their neighbour empires or kingdoms. However, after the fall of Dynastic Egypt, the spread of Christianity deepened and changed the role of religion in Egyptian society as it focused on the conduct of everyday life as a way of satisfying the will of God (Assmann, 2002). Consequently, religion attained more a much more comprehensive role in Islamic Egypt. The dominant Islamic interpretations claimed that the will of God dictated not only the everyday practices of Muslims but also the acts of governments. Moreover, Egypt assumed a special significance for the Islamic empire during the Middle Ages when it became the centre of the empire. For more than four hundred years, from the twelfth to the beginning of the eighteenth century, Egypt played a very strong and active role in defending the Islamic empire (Winter, 2008). Therefore, religion and war become more than ever linked in Egypt during this period.

In summary, the Nile and religion have been intertwined in Egyptian society since the Ancient Egyptian civilisation. The Nile has been crafted in the minds of Egyptians in the form of a dual informal institution. Firstly, Egyptians realised that the Nile is the source of their life and the grantor of their state. Second, they believed that their historical right to the Nile water was supreme over that of other riparian states. With regard to religion, it has been an important determinant of the very essence of Egyptian self-perception and therefore has influenced Egyptian relations towards other nations. Thus, the centrality of the role of religion in Egyptian society has been an important informal Egyptian institution.

1.2.1.2 Egypt and Sudan

The Nile and Islam have been the most significant factors in the relations between Egypt and Sudan. In general the role of these two factors has been positive. The absence of competition between the two countries over the river until the twentieth century made the Nile a source of cultural proximity. In addition, after Islam spread in the territories of Sudan it became the major link and common factor between the two nations.

Although Egypt and Sudan are the only two countries that share the main Nile River, they have never been in competition for its water. Although Sudanese territories receive the Nile flow before Egypt, the strength of the water flow and the severity of the climate hindered the people from exploiting its benefits (Powell, 2000). Egypt has always been the main consumer of the waters of the Nile while Sudan was only able to develop limited, primitive agricultural areas. The Nile has also been a major waterway for travel and communications from north to south and vice versa. This has developed various cultural interactions among the people who lived in Egypt and Sudanese territories. Since Egypt has had a stronger culture and state during most of history, it has been the country that affected its southern neighbour. Therefore, the Nile has represented a positive bridge between the two nations. Moreover, it has enabled Egypt to influence the culture of the people who lived in Sudan.

Although Islam did not deeply penetrate the territories of Sudan until the eighteenth century it has since that time become a major bond between the two nations. The Nubians, a Christian people of military skills who lived to the south of Egypt, stopped the Arab expansion to the territory now called Sudan. This "Nubian dam" slowed the Arabisation and Islamisation of the territory, leaving its population divided between the two religions (Ayalon, 2000). However, there was another reason for the delay of the penetration of Islam to the territories of Sudan, which was the widespread poverty and lack of resources. Therefore, even when Egypt had the necessary power to occupy Sudan, in the Middle Ages, its ruler abandoned the idea after sending an exploratory mission to assess the feasibility of such military expansion (Al-Umari, 1421). Therefore, Islam as a religion could not have been institutionalised in Sudan until Ottoman Egypt invaded Sudan in 1821 (Erlich & Gershoni, 2000). Egypt controlled most of the territories of Sudan from 1821 until 1885, three years after the British colonisation of Egypt in 1882. Sudan was reoccupied by the British in 1899 although nominally it was subject to a joint control by the Anglo-Egyptian authorities (Powell, 2000). However, although the Egyptian control was only nominal, Egyptian nationalists regarded Sudan as a historical, geographical and religious part of Egypt (Powell, 2000). For Egyptian people, given the geographical proximity and the common spiritual background of the two regions, Egypt and Sudan were irrevocably connected by the bonds of Islam and the Nile (Powell, 2000). Ahmed Lotfi Al-sayyid, a famous Egyptian intellectual, emphasised repeatedly that Sudan is a part of what makes up Egypt. For him, there is a Lower Egypt and Sudan is Upper Egypt (Powell, 2000). "The unity of the Nile Valley was as deeply ingrained in Egyptian national thinking as the flow of the Nile itself" (Warburg, 1992, p. xii). However, the superiority of Egyptian culture led to the development of sections of Sudanese elite opposing the Egyptian influence in Sudan. The balance of power between the supporters of Egypt and those who oppose its influence has been a major determinant of the direction of the relations between the countries over the last two centuries.

In general, it can be seen that the informal institutions of the relations between the two nations have been positive. Islam has been the main bond between

the two Muslim-majority nations. The Nile has also been an enabling factor for strengthening the cultural and social interactions between the two countries. However, it should be noted that its role has been second to that of religion. Although unity of the Nile valley has been claimed by major sections of the intellectual elites of the two countries in modern times, this unity was claimed based on the unity of religion more than the common ownership of the Nile. Moreover, it should be clarified that while the majority of Egyptians support the unity between the two countries, there has been a division within Sudanese elites over the same issue.

1.2.1.3 Egypt and Ethiopia

Contacts between Egypt and Ethiopia have existed since ancient times. On the one hand, some anthropologists have claimed that there was some African influence on the Pharaonic civilisation. On the other hand, some of the Ethiopian symbols and ceremonies have been argued to have Egyptian origins. While this evidence has led some to claim that the Ancient Egyptians were of Ethiopian origin, others have claimed that Ethiopian culture has been influenced by successive Egyptian migrations (Firmin, 2004). There are various historical references to contacts between the ancient Egyptian and Ethiopian kingdoms. Moreover, the old Ethiopian kingdom of "Kush" occupied Egypt from the eighth century until the mid-seventh century BCE. The people of this kingdom were named by the Greeks "Aithiopian", which means burnt-faced people, and their kingdom was named Aithiopia (Burstein, 2004). This kingdom was situated in "Meroe" a region located in the centre of what is now the Sudan. However, the Ethiopian-Egyptian relations started to intensify in the early medieval centuries and since then the two countries have become mutually interdependent (Pankhurst, 2000). Interestingly, these relations have been shaped also by religion and the Nile.

1.2.1.3.1 Religion as an Institutional Determinant of Ethiopian-Egyptian Relations

Christianity was the first religious determinant of the Ethiopian-Egyptian relation. The Ethiopian kingdom was the third political entity to adopt Christianity,

in the fourth century, after Armenia and the Roman Empire (Erlich, 2002). Since its very introduction in Ethiopia, Christianity has been not only the major religion of Ethiopians but also the major determinant of the Ethiopian identity. Ethiopian Christianity has played two main historical roles. First, it absorbed the local traditions and moulded with the popular beliefs to establish a common reservoir for the Ethiopian culture (Erlich, 2002). This enabled the Christian religion and Church to become the main source of legitimacy for the successive Ethiopian regimes. Second, Christianity has become the main link of Ethiopia with the outside world, and in particular with Egypt. The Ethiopian Church attached itself almost from its establishment to the Christian Coptic Church of Alexandria as a bishopric of the Egyptian Church (Erlich, 2002).

This vital link between the Egyptian and the Ethiopian Churches has resulted from of the historical evolution of Christianity in Ethiopia. Christianity was established in Ethiopia by two Syrian brothers who were rescued from a shipwreck on the Ethiopian coast. Later, one of them went back to Syria but the other went Egypt where he was consecrated by the Patriarch of Alexandria as a bishop of the Egyptian Church in Ethiopia. He was given the name “Salama” and the title of Abuna, which means “our father” in Arabic and Geez, or “abun” in Amharic (Meinardus, 1970). When he returned to Ethiopia he was recognised by the royal court as the head of the Ethiopian Church. From then until 1951, the successive heads of the Ethiopian Church were Egyptian monks appointed by the Egyptian Church to lead the Ethiopian Church, numbering 111 Egyptian Abuna in succession (Erlich, 2002). This led to the establishment of the Ethiopian Church as a daughter or a bishopric of the Patriarchate of Alexandria (Meinardus, 1970). This bond has remained until 1959 when the two Churches agreed to sever it, making the Ethiopian Church autocephalous (Erlich, 2002).

The institution of the Abuna as head of the Church deepened the Egyptian influence on Ethiopian society. It allowed the Copts to contribute to the development of Ethiopian religion, culture and state (Erlich, 2002). On the religious side, Egyptian monks migrated to Ethiopia to spread Christianity throughout the region (Erlich,

2002). Egyptian influence on the religious literature written in Geez, also known as Ethiopic, represents another Egyptian contribution to Ethiopian culture (Kaplan, 2008). Although early Ethiopic religious books were translated from Greek, translation from the Arabic Coptic sources increased from the thirteen century (Kaplan, 2008). Gradually, all the major elements of Ethiopia's culture and major languages became deeply influenced by the Egyptian Arabic culture. Moreover, on the political side, the Egyptian Abunas witnessed the coronations of kings and provided patriarchal legitimacy to them. The support of the Abuna was essential for any Ethiopian king to preserve power. Similarly, the network of monasteries and churches was crucial for maintaining state control and building loyalty (Erlich, 2002).

The spread of Islam in Egypt and the region added another dimension to the religious link between Egypt and Ethiopia. Islam has gradually unified the region of the Middle East and North Africa but could not reach the Ethiopian highlands because of the "Nubian Dam" as indicated above. However, Christian Ethiopia symbolised the accepted legitimate other for Muslims, including Muslim Egyptians. The Ethiopian view of Egypt was more ambivalent. On the one hand, Egypt was the holy land next to Palestine in which the Holy Virgin, the Holy Child and St. Joseph took refuge, and where the apostle St. Mark chose to have his seat. Moreover, the Ethiopian Orthodox Church drew its metropolitans from the Church of Alexandria and they were highly respected by the Ethiopian rulers and people. On the other hand, Egyptians were regarded with mistrust because of the control of the country by Muslim "outsiders", as they were regarded by the Ethiopians (Tafla, 2000). In the medieval period, when Egypt reached one its historical peaks and became the centre of the Islamic Empire, the Egyptian rulers extended their influence to the Ethiopian lands (Erlich, 2002). This was accompanied by an increase of Muslim merchants in Ethiopian society. These influences led to the spread of Islam in Ethiopia, gradually creating a significant Muslim minority. This marked the beginning of discord between Egypt and Ethiopia as Egypt was a Muslim-majority country with a Christian minority and Ethiopia has become a Christian-majority country with a Muslim minority (Meinardus, 1970).

1.2.1.3.2 The Nile as an Institutional Determinant of Ethiopian-Egyptian Relations

Although the Nile, or the Abbay, has a popular role in Ethiopian society, its importance in Ethiopian culture is far less than that in the Egyptian culture. While the Nile water has been the source of life for Egyptians, its tributary in Ethiopia, the Blue Nile, has given no life to Ethiopians. On the contrary, the strong and speedy flow has eroded their soil and killed people and cattle (Erlich, 2002). Therefore, instead of identifying themselves with the Nile as Egyptians have done, they identified themselves primarily in terms of the Christian religion (Erlich, 2002).

Yet, the Blue Nile has been the most popular river among Ethiopians although they have rivers that are comparable to it or even more economically useful (Tafla, 2000). The river has represented for them a major historical asset and their channel to retain their important connection with the Middle East (Erlich, 2002). Some of the Ethiopian legends depict the Blue Nile as the route of migration from Egypt to Ethiopia under the pressure of famine and religious oppression and as a means of communication between the rulers of the two countries (Tafla, 2000). Moreover, the ancient Ethiopian traditions depict the Blue Nile as a river of two countries: Ethiopia as the source of the river and Egypt as main user of the Nile water (Tafla, 2000). Therefore, the Ethiopian historical sources of the pre-nineteenth century mainly recognise Egypt as the only African state besides Ethiopia itself (Tafla, 2000).

The Nile has been a significant institutional factor in relations between Egypt and Ethiopia. Egyptians have always believed that Ethiopia was the source of their Nile. Although the fact that the Blue Nile is the main source of the Egyptian Nile was confirmed only at the beginning of the twentieth century, Egyptians and their rulers from ancient times realised that the Nile water came from Ethiopia (Erlich, 2002). Moreover, they were convinced that the Ethiopians were capable of controlling or even obstructing the flow of their Nile. Ethiopia's supposed capability to control the Nile flow was a source of pride for Ethiopians and put pressure on Egyptians (Pankhurst, 2000). This alleged ability of the Ethiopians to divert the Nile water and

cause famine in Egypt was among the repeated threats of the Ethiopians to the Egyptian rulers (Winter, 2008). Although this alleged capacity has never been tested until the last few years, this claim has significantly influenced the history of the relations between the two nations.

1.2.1.3.3 Interdependence between Informal Institutions: Religion and the Nile

The medieval period represented the main formative period for Egyptian-Ethiopian relations. During this period, these relations assumed special significance when the two countries were both very powerful. Egypt was the centre of the Mamluk Sultanate which was very strong and active in defending the Islamic empire and institutions for almost three hundred years (1250–1517). During almost the same period, Ethiopia was a powerful Christian state devoted to the development of Christianity in the region (Winter, 2008). This led to the establishment of multifaceted Ethiopian-Egyptian relations that revolved around religion and the Nile. While Muslim Egypt´s welfare depended on the water and silt brought from Ethiopia by the Nile, Christian Ethiopia depended on the Coptic Church of Egypt, from where the Ethiopian patriarch (Abuna) was selected (Pankhurst, 2000). The mutual interdependency between the two countries became very tangible. While Ethiopia was the source of the Nile for Egypt, Egypt was a major source of religious guidance and political legitimacy for Ethiopia. The Coptic Church was the source of their Abuna, who was not only a religious guide for the Christian Ethiopians but also a major agent in providing legitimacy to the Ethiopian political regime (Erlich, 2002). The Abuna was second to the Ethiopian king and sat to his right to symbolise the unity of the cross and the crown (Erlich, 2002). At the same time, Egypt was the main centre of Islam and a major source of Muslim clerics for the Muslim Ethiopians (Erlich, 2002).

Nevertheless, although the relations between Egypt and Ethiopia in the medieval period became stronger than before at the same time it became more conflicted. During this period, the rivalry between the two regimes made the mutual interdependency between the two countries unstable. The dependence of Egypt on

Ethiopia was unstable not only due to natural conditions, as the Nile floods vary varied from time to time according to climatic changes, but also Ethiopian threats of human intervention added more insecurity to this relation. On the other hand, the Ethiopian dependence on Egyptian also became unstable due to human factors (Pankhurst, 2000).

Claims of the Ethiopian ability to control the Nile were made by several Ethiopian rulers. Although there is no evidence of their ability to do so, these threats reflected the depth of this belief in the consciousness of both nations. One example of the historical accounts that referred to such a belief is written by Al-Qalqashandi, an Egyptian historian who lived in the thirteen century. According to him, the Nile had failed to rise in 1093 as a result of the deterioration in its riverbed coming from Ethiopia. Therefore, Sultan Al-Mustansir Billah sent the Egyptian Coptic Patriarch to the Ethiopian ruler to treat with them so that consequently the Nile would resume its usual flood (Al-Qalqashandi, 1418). Another version of the story is reported by Al-Makin, an Egyptian Coptic historian, who stated that the Nile's failure was a result of Ethiopian intervention. This account also claimed that once the Ethiopian king yielded to the patriarch and ordered a dam to be broken, the Nile flow increased and its level rose by three cubits in one night (Meinardus, 1970; Pankhurst, 2000). This belief in the Ethiopian capacity to control the Nile led various Ethiopian kings repeatedly to threaten blocking the Nile in order to achieve their political goals. Various Egyptian and Ethiopian traditions have referred to such repeated Ethiopian threats. For instance, one Egyptian account stated that the Ethiopian king Zara Yaqoub made such a threat to the sultan of Egypt Al Zahair Jaqmaq in the fifteenth century in response to his anti-Coptic actions. In a letter to the Egyptian sultan, the Ethiopian king threatened him by reminding him that the River Nile flows from Ethiopia to Egypt and that the Ethiopians were able to prevent its floods that irrigate the land of Egypt but their belief in God kept them from doing so (Al-Sakhawi, 1643). Similarly, some of the Ethiopian accounts mention similar stories. For instance, one account claims that in the thirteenth century the Egyptian ruler refused to pay the accustomed tribute to Ethiopia. Therefore, the Ethiopian king prayed for God to stop the Tekeze, one of the tributaries of the Nile, for three years and seven months. Egypt

reportedly suffered from famine until its ruler sent gifts to the Ethiopian king begging him to resume the Nile flow (Pankhurst, 2000). Although these accounts are not fully convincing historically, they reflect the belief of both Ethiopians and Egyptians in the Ethiopians' ability to control the Nile.

One interesting point is that not only the Egyptians and the Ethiopians believed in the ability of Ethiopians to control the Nile but also European powers in the medieval period held the same belief. The Portuguese rulers had the control of the Nile as one of the objectives of their explorations in East Africa. During the Muslim-Christian conflicts of the medieval period, Albuquerque, Viceroy of Portugal at the beginning of the sixteenth century had the ambition to conquer Mecca in order to exchange it for Jerusalem. Interestingly, to achieve this goal he sent explorers to East Africa to establish communications with the king of Ethiopia (Hamdani, 1992). His objective was to establish an alliance with the king of Ethiopia to divert the Nile from Ethiopia to the Red Sea and thus to starve Egypt (Hamdani, 1992). He believed that this would lead to the collapse of Egypt, the Islamic empire's leading power at that time, and hence the conquest of Mecca would be possible.

If the Nile was the Ethiopian card, however, then the Egyptian card was the ability of the sultan or the Coptic patriarch to delay or avoid consecrating an Abuna (Erlich, 2002). Several historical accounts have emphasised that the Abuna´s consecration depended on Egyptian goodwill and efficiency. Ibn Fadl Allah Al-Umari (d. 1349), a historian who worked as a chancery official in Cairo and Damascus, emphasised that the Ethiopian bishop could only consecrated by the Egyptian Coptic Patriarch upon a request accompanied by precious gifts from the Ethiopian king. He added that Ethiopians had always claimed that they maintain the Nile riverbed and enhance its flow to satisfy the Egyptian sultan (Al-Umari, 1421). Moreover, several attempts were made to increase the number of bishops in Ethiopia, but to ensure the dependence of the Ethiopian Church on that of Alexandria the Abuna was not allowed to consecrate more than seven bishops. If the Ethiopian Church had twelve bishops, the number necessary for the enthronement of a patriarch, the Ethiopians might have separated from the Alexandrian Church (Meinardus, 1970). The fact that the Egyptian rulers had the power to deny Ethiopia its top religious leader, who had

a powerful and highly respected status in Ethiopian society, was a source of friction between the two nations in various episodes of their common history, especially in the medieval period.

Another factor that increased the sensitivity of the relationship between Egypt and Ethiopia was the problem of their reciprocal minorities. Egypt was a Muslim-majority country with a Christian minority and Ethiopia was a Christian-majority country with a Muslim minority. Therefore, the conditions of the two minorities were closely linked in the two countries (Meinardus, 1970). This link has taken various forms. Firstly, the authority in one country used to make its religious minorities victims or hostages when their coreligionists were being oppressed in the other country (Winter, 2008). Another form was the emphasis of Ethiopian rulers in their correspondence with their Egyptian counterparts on the good treatment received by their Muslim minority. This was a concealed threat that it could be reversed. As indicated above, when the Egyptian Sultan Jaqmaq committed a series of anti-Coptic actions, he was threatened by the Ethiopian king with blockage of the Nile. Moreover, he reminded the sultan of his ability to retaliate by maltreating the Muslims who were living in the Ethiopian lands (Al-Sakhawi, 1643). According to Al-Makin, when Sultan Al-Mustansir Billah threatened to destroy Coptic churches the Ethiopian king threatened him that he would retaliate by demolishing Mecca and sending its stones to him (Erlich, 2002). The positive side of this dimension of Egyptian-Ethiopian relations was that it allowed the two minorities to enjoy good treatment most of the time. The Coptic Egyptians and Muslim Ethiopians maintained a respected status in their countries. Moreover, interestingly, Ethiopian and European accounts highlighted the special treatment that Ethiopian pilgrims to the Holy Land received from the sultans of Egypt. According to various accounts, Ethiopians were the only pilgrims exempted from tribute when passing through Egypt to the Holy Land. Moreover, they were allowed to carry the cross uncovered through the Egyptian (Munro-Hay, 1997).

The contention over hydrological and religious links between the two countries was transmitted to the modern times. When Khedive Ismail, who ruled Egypt from 1863 to 1879, aimed at attaining regional Egyptian hegemony he

concentrated on its African continental neighbours, focusing on the Nile Basin (Hatina, 2008). The efforts of Khedive Ismail to create this Egyptian empire were partly induced by the motive of securing the Nile sources (El-Atawy, 1996). Egypt planned to dominate the central African plateau by establishing a network of garrison stations from the Red Sea to the inland areas around Lake Victoria (El-Atawy, 1996). When Egyptian forces attempted to conquer Ethiopian territories, the Ethiopian ruler attempted to get European support against the Egyptian invasion by raising the issue as an Islamic threat to Christian Ethiopia. The European powers ignored him, however, and implicitly supported the Egyptian Khedive (Hatina, 2008). Although this attempt failed in 1876, it led to a rise in Ethiopian nationalism against Egypt (Tafla, 2000). On the other side, the resort of the Ethiopian king to a religious discourse to gain the support of the Christian West weakened the religious links between the two nations and projected Ethiopians as a "distant other" in the minds of Egyptians.

In conclusion, informal institutions that have characterised Egyptian-Ethiopian relations have been related to two main determinants: the Nile and religion. With regard to the Nile, two informal institutions can be distinguished. The first is that both countries have believed in their superior rights on the Nile water. The unlimited use of the Nile water by Egyptians and its crucial importance for their lives have bequeathed to the Egyptians a belief in their historic rights on the water of the Nile. At the same time, Ethiopians have always believed that they have the supreme rights over the Nile because they have its main source in their territories. This has resulted in conflict over ownership of the Nile in the minds of Egyptians and Ethiopians. In other words, there has been a conflict between the informal institutions that dedicate the ownership of the Nile water between the two nations. The second Nile-related informal institution is the belief of both nations in the Egyptian dependence on the Ethiopian Nile floods. Although such dependence, if it was true, could have been employed for the benefits or the harm for Egypt, the repeated Ethiopian threats of preventing the floods of the Nile has led to a negative view of Egyptian water dependency on Ethiopia in the minds of Egyptians. In summary, the two countries are linked but also divided by the Nile (Pankhurst,

2000). With regard to religion, the Ethiopian religious dependence on Egypt is the main informal institution. However, this religious dependence has been negatively affected by the political competition between the rulers of the two countries.

1.2.1.4 Egypt and Uganda

Contacts between Egypt and Uganda have been relatively recent compared with the ancient historical relations with Sudan and Ethiopia. The recorded history of the population that forms the modern Ugandan society can be traced to the Middle Ages. However, and in contrast to Ethiopia and Sudan, Uganda was not in direct contact with Egypt until the eighteenth century.

A major milestone in the formation of the social and political organisation of the modern Uganda was the migration of Luo-speaking tribes from Southern Sudan into north-western parts of Uganda during the fifteenth or sixteenth century (Karugire, 1980). Although the cause of this migration is not known it is thought that it was part of wider and gradual social movement in Africa southwards (Karugire, 1980). These migrant groups established various tribes and small kingdoms that spread around the equatorial lakes (Karugire, 1980). Among these traditional kingdoms, two strong competitive kingdoms can be distinguished in northern Uganda, Bunyoro and Buganda (Karugire, 1980). The kingdom of Buganda represented the major polity in Uganda and its elite controlled the north-eastern area of Lake Victoria, which represents the southern part of today´s Uganda, by the nineteenth century (El-Atawy, 1996). Buganda had a strong central government that was able to develop a rain-fed agriculture sector, achieve advances in construction and mobilise a strong army (El-Atawy, 1996).

The powerful government enabled Buganda to extend its domain and to defeat its traditional rivals, mainly Bunyoro, and thus it came in contact with Egypt which was also extending its domain (El-Atawy, 1996). The Sudd swamps in South Sudan had been the main barrier to navigation through the Nile to Lake Victoria. In fact, the name of the region “Sudd” come from the Arabic word “sadd”, meaning a barrier (Collins, 1990). During the first half of the eighteenth century that various

Egyptian expeditions attempted to reach the source of the White Nile but failed. However, these failed expeditions gradually cleared a river route through the Sudd swamps. This route was used first by merchants and missionaries then by geographers and explorers. It was not until 1863 that a British geographer, Samuel Baker, reached waters of Lake Victoria. In 1870, the Egyptian Khedive Ismail sent Baker at the head of an Egyptian expedition to suppress the slave trade and occupy the equatorial regions as an Egyptian province (Collins, 1990). Egypt succeeded only in extending its control to the regions of South Sudan in 1874. The absence of previous significant contacts with the native inhabitants of Uganda made the Egyptians very conservative and cautious in these early interactions with the Ugandan tribes. The Egyptians relied more on peaceful means to dominate the Lake Plateau. Arriving in the equatorial lakes region, the Egyptian forces attempted to convince the king of Buganda to accept Egyptian protection while maintaining control over his kingdom. However, these efforts failed because of the conflict of goals of the two parties. The Bugandan king sought an alliance with the Egyptian authorities on equal footing while providing his the necessary support against his local enemies. On the other hand, the British commander of the Egyptian forces did not want to engage in local conflicts. Therefore, Egyptian control was limited to the regions that are located to the north of Lake Victoria and lasted until 1889. Therefore, although the two parties failed to reach a lasting agreement of alliance, they succeeded in avoiding significant military confrontations (El-Atawy, 1996). Later, the British followed the Egyptian strategy and formalised an agreement that allow the Bugandan elite to play the role of the local administrators for the British colonisation while keeping their traditional institutions and power (Thompson, 2003).

To conclude, the relatively short history of the relations between Egypt and the Ugandan population has resulted in a lack of knowledge between the two societies of each other. More importantly, the ruling elite of Egypt suffered from lack of understanding of the geography of the Ugandan territories and population. Therefore, Egyptians could not understand the similarities and differences of the tribes living on the Ugandan territories. Similarly, Egyptian rulers and the rulers of

the major Ugandan tribes did not have a clear assessment of the value of their hydrological interests with each other. Therefore, two informal institutions marking Egyptian-Ugandan relations can be distinguished: “neutrality” and “prudence”. If Sudanese have been considered by Egyptians, and vice versa, as “brothers” and Ethiopians were portrayed as “the competitive others”, Ugandans were “the unknown others” for Egyptians.

1.2.2 Formal Institutions

There was no formal inter-state institutional framework regulating the relations among riparian countries over the Nile Basin by the end of the nineteenth century. On the regional and bilateral levels, most of the Nile Basin riparian countries had not yet come into existence or were still in the early phases of establishment. Therefore, there was an absence of any bilateral or regional treaties. On the international level, the law of non-navigational uses of international waters was in its infancy.

Although there were some basic customary rules representing the main issues of international watercourses, there was no international treaty in force that regulated the non-navigational uses of international watercourses. In general, the sources of the rules of international law are: treaties and conventions; international customs; general principles of law recognised by civilised nations; and judicial decisions and legal teachings (Thirlway, 2003). In the absence of international regional treaties, the rules of law for non-navigational purposes of international watercourses have been derived from the other sources. These rules have regulated the issues of the use allocation, protection and improvement of international river watercourses. Four principal doctrines had prevailed in this by this period of study: absolute territorial sovereignty; absolute territorial integrity; community of interests and limited territorial sovereignty. (Spiegel, 2005).

The first of these doctrines was the theory of absolute territorial sovereignty. Under this theory, a state may act freely with regard to the water flowing in its territories without any restraint regardless of any harm to other riparian countries (Malla, 2009). This theory is also known as the Harmon Doctrine from the United States Attorney General Judson Harmon who offered such an opinion in a dispute between the United States and Mexico over the Rio Grande in 1895. In this dispute, Harmon stated that a state is totally free to dispose of the water flowing in its portion of international without any consideration of any harm its actions may cause to others (Malla, 2009). This doctrine has never actually been put into practice and even this dispute itself was resolved in 1944 by a treaty between the United States

and Mexico that relied primarily on an equitable allocation scheme and not on this doctrine (Spiegel, 2005). Moreover, the Harmon doctrine was raised again during the Congressional hearings in the ratification process of the treaty, but it was refuted (Spiegel, 2005). Clearly, this theory favours upstream countries at the expense of downstream countries.

The second theory is that of absolute territorial integrity which represents the antithesis to the Harmon Doctrine. This doctrine is also known as the natural flow of rivers or riparian rights. It embodies the idea that a riparian state has the right to demand the continuation of the natural flow of water into its territories, in terms of both quantity and quality (Malla, 2009). According to this theory, a riparian state is entitled to the flow of water unchanged in quality and undiminished in quantity (Malla, 2009). However, it holds that a state should also not restrict such natural water flow to other riparian countries downstream (Salman, 2007). This means that an upstream country should not affect the natural flow of water to the downstream country (Spiegel, 2005). Two interrelated doctrines have been tied to this theory: the no-harm doctrine and the doctrine of prior appropriation. The no-harm doctrine advocates that a country may not take any action that causes any harm to the natural flow to other riparian countries (Spiegel, 2005). The doctrine of prior appropriation was derived from the so-called master principle of appropriation, or of senior or acquired rights, that was inherited from the water law of the western United States (Waterbury, 2002). This principle dictates that the one who uses water first establishes a right to it, i.e. "first in time, first in right" (Spiegel, 2005). This doctrine protects the prior appropriation rights by adverting all second-in-time users to avoid actions that might harm those with senior rights (Waterbury, 2002). In other words, this doctrine holds that the senior water right must be fully fulfilled before the next most senior water right is fulfilled (Spiegel, 2005). This theory is closely related to the resolutions of the Institute of International Law (IIL)[1]

[1] The Institute of International Law (IIL), or Institut de droit International (IDI), is a scholarly international non-governmental organisation that was established in 1873 (Malla, 2009). It is mainly a scientific body that is composed of distinguished elected jurists. It has made important contributions to the law of international watercourses (Malla, 2009). The IIL adopts resolutions and rules that are not legally binding but possess a considerable authority because they represent the opinion of respectable expertise in international law and usually encompass the established

(Salman, 2007). This institution adopted the no-harm doctrine in its resolution in 1911, known as the Declaration of Madrid, which established absolute prohibition against activities that may cause any harm to other riparian countries (Salman, 2007). The Declaration stated explicitly that the upstream country should not establish any project that may modify the utilisable character of water when it reaches the downstream countries (FAO, 1998). Similarly, the declaration holds that a downstream country should establish any construction or establishment that would subject the other country to the danger of inundation (FAO, 1998). Since the necessary technology that can allow upstream countries to benefit from their water has evolved only in the last century, most of the downstream counties hold senior rights over their transboundary rivers. Therefore, although this doctrine theoretically protects the prior appropriation rights of all riparian countries regardless of their location on the river, in practice it enhances the claims of downstream countries.

The theory of the community interest of riparian states has extended the theory of absolute territorial integrity. This theory views the watercourse as a natural and physical unit and therefore has obliged the riparian countries to serve their common interests (Spiegel, 2005). These interests include the present and future uses of the watercourse and the ecosystem of the water course. Moreover, this doctrine has implied that the sovereignty of a riparian state with regard to its part of the river is relative and that it should take into consideration the needs and interests of other riparian states (Malla, 2009). This theory originally developed from the navigation-related agreements reached in the nineteenth century. The negotiations of the navigational uses of international watercourses began at the beginning of the eighteenth century, much earlier than that of the non-navigational uses of watercourses. These negotiations resulted in successive informal and formal agreements that established a natural right of free navigation for all and obliged the riparian countries to maintain the ecosystem watercourse for all (Malla, 2009). Moreover, the concept developed of a watercourse regime that is responsible for the watercourse basin. This has been the basis for the idea of the community of interests

customary principles of international law (Salman, 2007).

of all riparian countries. However, this theory has not been widely accepted as it severely limits the sovereignty of riparian countries.

The fourth doctrine is the theory of limited territorial sovereignty which has evolved gradually as a middle ground between the competing theories since the early years of the twentieth century. It states that each riparian country must respect the rights of other riparian countries because they all have an equality of right (Spiegel, 2005). This theory is closely connected with the doctrine of equitable utilisation that is based on the principle of hybrid rights, which holds that each riparian country has an entitlement to an equitable share and beneficial uses (Malla, 2009). This doctrine allows for various factors for allocating the water uses and share among riparian countries on a case by case basis. Originally, this doctrine was also inherited from western US water law. In 1907, the Supreme Court of the United States introduced the equitable apportionment doctrine in the conflict between Kansas and Colorado over the Arkansas River. In this case, Colorado, the upstream riparian state, claimed its right using Harmon Doctrine and Kansas defended its historic right using the prior apportionment and no harm doctrines. However, the court rejected both positions and introduced the doctrine of equitable utilisation allowing Colorado to withdraw water for irrigation as long as it did not intrude on Kansas's share of the water (Spiegel, 2005). The same doctrine was utilised in various cases by the United States Supreme Court during the twentieth century.

To conclude, during this period the hydro-political relations among the Nile Basin countries have not been subject to any formal bilateral or regional institutions. Moreover, the international institutional framework that regulates the non-navigational uses of watercourses was in its early stages of development. Four institutions (doctrines) were in place but they differ in the obligations and rights of riparian countries and neither of them had a binding authority on riparian countries. Two of them, absolute territorial sovereignty and absolute territorial integrity, prevailed in this period. The other two, community of interests and limited territorial sovereignty, were evolving during this phase.

1.2.3 Interaction between Informal and Formal Institutions

The diversity and the difference between these legal theories has meant that there has no binding international institutional framework. This has enabled each of the Nile riparian countries to resort to the legal institutions most compatible with their informal institutions and serve its interests. However, the degree of interaction between the formal and informal institutions has varied among the Nile riparian countries.

Although all riparian countries have been subject to the same international formal institutional framework, each country has established its own institutional framework. The evolution of societies and the state of technology in Sudan and Uganda have not enabled them to establish a strong cultural link with the Nile. Egypt and Ethiopia have been the main countries that developed strong Nile-related informal Institutions. With regard to Egypt, the informal institution of Egyptians of their historic rights of the water of the Nile has been reinforced by the formal institution of absolute territorial integrity and prior rights of riparian countries. To the contrary, the Ethiopians have complemented their informal institutions of their ownership of the Nile water with the formal institution of absolute territorial sovereignty. This has widened the gap between the two countries and put them into confrontation in all their Nile-related interactions.

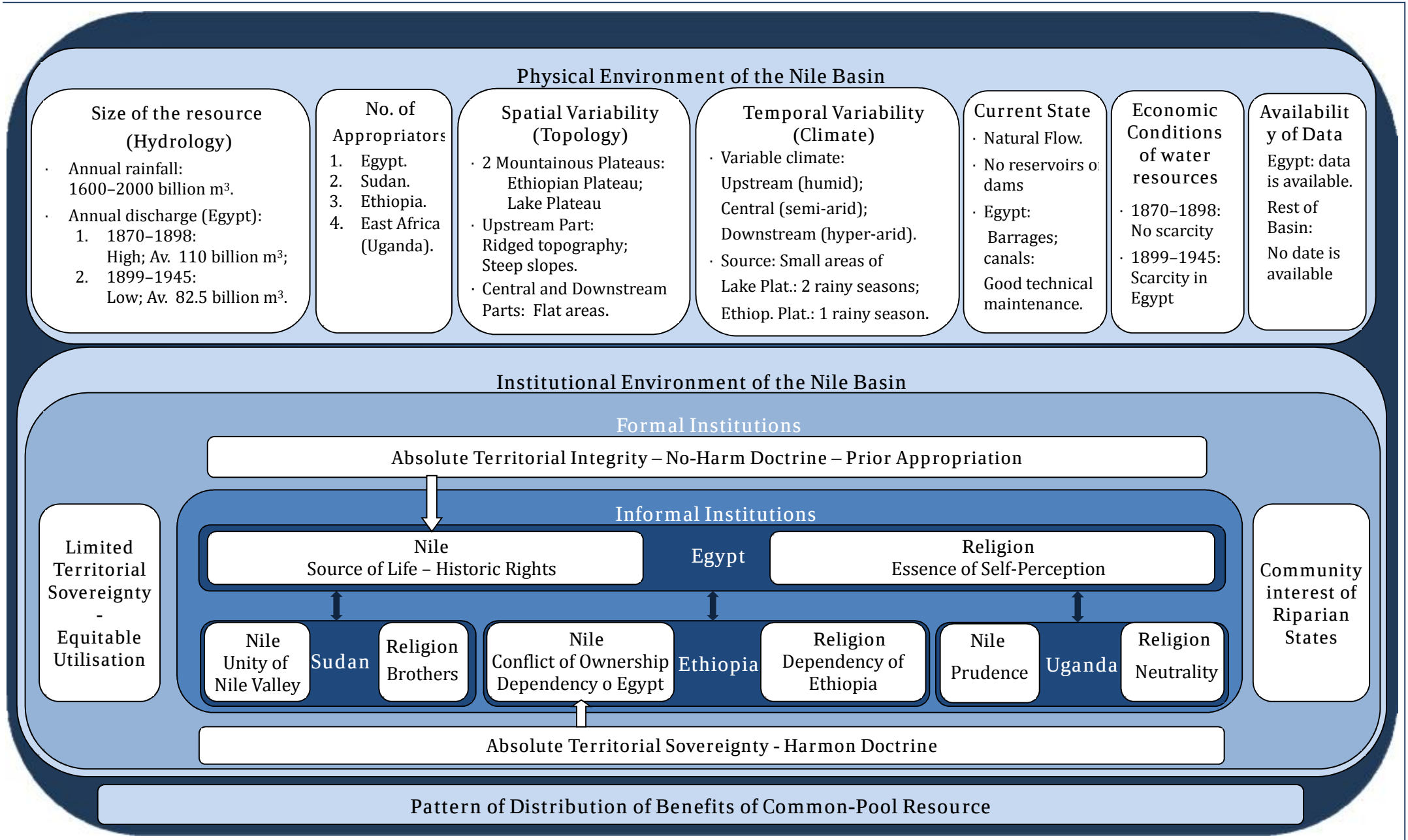


Diagram 6-4: Institutional structure of the Nile Basin – Institutional Environment

1.3 Pattern of Distribution of Benefits of the Nile

The absence of legal institutions and technological controls has made the use of Nile water subject only to the conditions of the physical environment. At the beginning of this historical period, the flow of the Nile was natural and not subject to any controlling structures, such as reservoirs or dams. Moreover, there was no formal legal governance mechanism governing the Nile. Therefore, the pattern of distribution of the benefits of the river was subject to the topography, hydrology and the climate conditions of the Nile Basin (Tvedt, 2004).

These factors differentiated between the benefits that accrued to the downstream countries and upstream countries. The Nile flow has made irrigation-based agriculture possible on a large scale in Egypt. The vast area of Sudanese territories made it subject to different climatic and hydrological conditions. Therefore, although irrigation-based agriculture was possible with difficulty in northern Sudan, the swamps of southern Sudan made it only suitable to serve as grasslands for cattle (Tvedt, 2004). However, this did not mean that the upstream countries were completely prevented from the benefits of the Nile Basin. These countries relied mainly on the rainfall over the basin which is technically part of the Nile water. The rainfall in most parts of the Ethiopian kingdom and East African territories facilitated rain-based agriculture and obviated the need for irrigation-based agriculture (Tvedt, 2004). .

Finally, it should be emphasised that there is no accurate data about the Nile flow and its distribution for this period except that which was recorded by the Nilometers in Egypt. With exception of Egypt, veils of ignorance cover the benefits accruing to each riparian country whether directly from rainfall or from the river flow (Waterbury, 2002). In the late nineteenth century the Nile discharge was recorded at Aswan, at the southern border of Egypt, and then at Cairo. As was indicated above, the average annual discharge received by Egypt was nearly 110 billion cubic metres during the period from 1870 to 1898. Sudan is estimated to have withdrawn less than one million cubic metres annually for irrigation-based

agriculture during the same period. All other riparian countries mainly relied on rainfall for their subsistence agricultural uses.

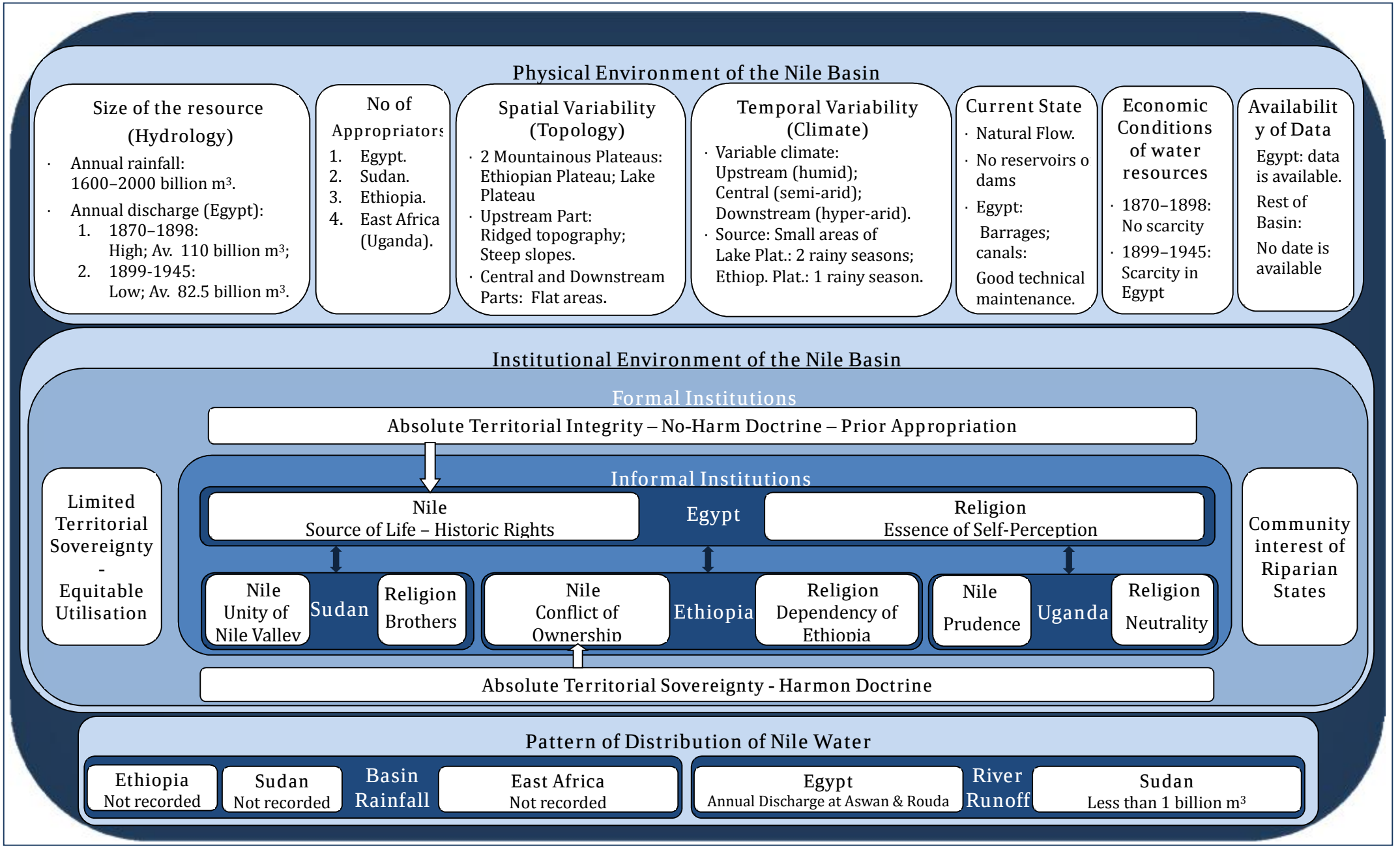


Diagram 6-5: Institutional structure of the Nile Basin – Pattern of Distribution of Nile Water

1.4 Egyptian National Institutional Environment

This section traces how the different levels of institutions of Egyptian society in this period influenced the benefits accruing from the basin-wide institutional structure of the Nile water to Egyptian people. First the macro-level institutional environment will be analysed. This analysis will attempt to trace the Nile-related informal institutions of Egyptian society as well as the formal institutions that evolved during the nineteenth century. Consequently, the micro-level organisational structure that governed the utilisation of Nile water that evolved during the nineteenth century will be explored. Finally, the impact of the Nile water use on the capabilities of Egyptian people by the end of the nineteenth century will be assessed.

1.4.1 Informal Institutions

The Nile has played a central role in shaping the Egyptian state and society. "The Nile acted as a principle of order and centralization" (Moret, 1927, p. 34). Egypt was a hydraulic society which established a technocratic government that regulated water usage between citizens guided by the principle of justice (Hamdan, 1967). Four features of ancient Egyptian civilisation can be considered pertinent to this study. While two of these features can be considered among the strengths of the ancient Egyptian state, the other two were among its weaknesses. On the positive side, the ancient Egyptian civilisation was a cooperative society with a central government, especially in irrigation and agriculture (Hamdan, 1967). On the negative side, it should be noted that the evolution of land ownership in the late period of this civilisation led to an uneven pattern of ownership that has continued and exacerbated until the modern era of Egypt. Equally important, one of the limitations of the government of ancient Egypt was that it did not expand its central role in the organisation of irrigation water to the provision of drinking water.

Ancient Egyptian society was a cooperatively organised society that did not know individualism or self-interest. Its existence and continuity depended on reciprocity and mutual responsibility induced by the high population density and

the shared irrigation system (Hamdan, 1967). The Nile functioned as the base of division and organisation of districts in ancient Egypt. From the north to the south of the Egyptian part of the Nile valley, each major basin of irrigation was considered as an agricultural district that became a political province (Moret, 1927). Since the Nile flowed through these provinces one by one from the south to the north of Egypt, each province influenced the one posterior to it and depended on the one anterior to it. Therefore, this geographical organisation created a social organisation based on mutual interdependence between the Egyptian provinces.

The central government was created to respond to the social organisation of Egyptian society. All the provinces accepted their mutual interdependence based on reciprocal discipline. This discipline was composed of rules governing irrigation that were just and accepted by all provinces. According to this discipline, Egyptians had the right to use the Nile water without any limitation as long as they did not breach the irrigation rules (Hamdan, 1967). However, the enforcement of such discipline necessitated the existence of a central state apparatus superior to all these provinces (Moret, 1927). Moreover, a state bureaucracy was also needed to govern the storage of crops as well as their distribution. Therefore, the Egyptian state not only governed the communal irrigation system but also developed a centrally-managed harvest storage system. The objective of this system was to alleviate the negative consequences of the unpredictable fluctuations of the Nile floods and to achieve self-sufficiency (Assmann, 2002). This system was based on a centralised supply system in which the farmers supplied their annual produce to the central government. Consequently, the government provided the citizens with their annual needs (Assmann, 2002). The efficiency of such bureaucracy encouraged the successive regimes, both Egyptian and foreign, to preserve its main structure and organisation until modern times.

However, it should be noted that land ownership was introduced in the late period of Pharaonic Egypt in a very uneven pattern. The majority of the Egyptian territories maintained the abovementioned autarchic economy during the first two millennia of Egyptian history. Landownership appeared gradually during the New Kingdom when land could be sold and bought freely among peasants. However, this

ownership was concentrated in the hands of the king, the priesthood and bureaucrats (Lewis, 2009). Therefore, a significant part of the population worked as labourers on the farms of noblemen and of the temples (Lewis, 2009). This pattern of elitist ownership of agricultural land was maintained during the reign of successive colonisers of Egypt. Moreover, it was exacerbated during the Mamluk and Turkish regimes in the medieval period that extended until the beginning of the nineteenth century.

Another important aspect of the organisation of the ancient Egyptian state is that centralisation of control of irrigation water was not extended to drinking water. Since the establishment of the ancient Egyptian state, Egyptians used to dig holes on the banks of the Nile to reach water to drink (Ray & Jain, 2011). Employing this technique, they achieved clean water using the soil to filter the water. Moreover, around 1500 BCE they started to apply the chemical alum to contaminated water in a special pot, allowing impurities to settle out of the water, then siphoned it into a storage pot ready to drink (Ray & Jain, 2011). It was not until the Islamic conquest of Egypt that the state started to extend its water projects to include channels and clay pipes to bring drinking water into private houses (El-Gohary, 2012). However, these projects were limited to the certain elite classes of society. To get their water supplies, most of people relied on the *saqqa*, who was a person responsible for bringing water from public cisterns to private residences (El-Gohary, 2012).

Therefore, four informal institutions can be distinguished in the Nile-related Egyptian institutional environment. Two of these institutions had relatively positive impacts on Egyptian society. The first is the mutual interdependence, or reciprocal discipline, between members of society who used water to irrigate their agricultural lands. The second is the centrality of the role of the state in Egyptian society in organising irrigation and agriculture which was among most distinctive features of the Egyptian culture. The two other institutions led to structural imbalances in the Egyptian society. The first was the legacy of unbalanced land ownership that led to disparity between the ruling elite classes and the rest of the people. This disparity was reflected also in the selectivity of the role of the state in the distribution and

treatment of drinking water, which was limited to serving only the higher classes of the society.

1.4.2 Formal Institutions

The modern era of Egypt dates from the beginning of the nineteenth century under the reign of Mohammed Ali Pasha. Mohamed Ali ruled Egypt under theoretical Turkish control as viceroy of Egypt from 1805 to 1848. During this period, he led a series of reforms in various fields to serve his dream of building a great empire with Egypt at its centre. His major concern was to increase the revenues of the state to enable it to finance the military expenditure of his future empire. Since he realised that agriculture was the major source of revenue of Egypt, he led various changes to increase agricultural production in Egypt (Chesworth, 1994). The expansion of the agricultural sector and its increasing complexity put the regulation of irrigation water at the top of the priorities of the Egyptian regime to achieve its economic goals. However, Mohamed Ali did not carry out any reforms in the provision of drinking water.

The main change introduced by Mohamed Ali was the shift from basin to perennial irrigation. While basin irrigation relied mainly on the annual Nile flooding during August and September, perennial irrigation technically regulated the Nile flow to make irrigation water available throughout the year (Elmusa, 1991). This regulation was achieved through the building of canals, barrages and reservoirs. Perennial irrigation enabled farmers to produce two and sometimes three crops on their land each year (Elmusa, 1991). The agricultural year is divided into three seasons: *nili*, when the Nile flood is high from September to November; *shetwi*, or winter season, from December to March, and *sifi*, or summer season, from April to August (Lloyd, 1956). Maize, rice and millet are grown in both the flood and summer seasons. The winter season is characterised by the crops of wheat, barley, clover and beans. Finally the two most important crops of Egypt, cotton and sugar cane, are harvested only in the summer season, as well as peanuts and sesame (Lloyd, 1956).

This radical change in the irrigation and agriculture systems necessitated a supportive regulatory framework. Therefore, two laws were enacted during the nineteenth century. The first aimed to organise the irrigation-related public works, and the second specified the powers of the governors of provinces and inspectors of irrigations. The public works law enacted by Khedive Tawfik in 1880 was the first modern irrigation regulation to be enacted in Egypt. It set the technical and operational rules for the maintenance of canals and bridges. From a social perspective, the negative aspect of this regulation was that it legalised the use of forced labour in the periodical maintenance of the irrigation canals and bridges (Al-Kadi, et al., 1987). The second law focused on regulating the acts of the officials working in the irrigation field. It was enacted in 1885, during the reign of Khedive Tawfik and after the occupation of Egypt by the British forces. The main achievement of this regulation was that it prepared the way for the irrigation laws that were to follow. Otherwise, it was driven by the logic of the maximisation of the revenues of the state. It formalised the traditional centralisation of power that has been characteristic of the Egyptian system since ancient times. The law did not oblige the government to change the plan of water distribution as a compensation for resources. There was nothing in the law that required a certain water discharge to be supplied in any canal during any part of the year (Johnston, 1903). It left the whole authority to the top officials in the Ministry of Irrigation to decide upon the distribution of water in order to maximise the agricultural production and the revenues of the state.

Meanwhile, in spite of the increasing population, the provision of drinking water continued its long inherited tradition of being unregulated. With the exception of the elite classes of society in the two largest cities, Cairo and Alexandria, people relied on their primitive means or the personal services of the *saqqa* for their drinking water supplies. Therefore, while there was a need for better irrigation laws, it was more urgent to bring about not only the enactment of a regulatory framework but a more comprehensive system for the supply of drinking water (Johnston, 1903).

Therefore, it can be concluded that the formal institutional framework of Egypt at the end of the nineteenth century was the result of selective interventions

of the Egyptian regime to serve its political and economic objectives. With regard to the Nile water, only two laws were enacted to organise the irrigation sector.

1.5 Governance Institutional Structure

1.5.1 Informal Institutions

Using modern economic terms, the economy of Pharaonic Egypt can be considered an ancient command economy. Since agriculture created most of Egypt's wealth, irrigation had primacy in the uses of Nile water. Therefore, the ancient Egyptian bureaucracy monopolised the provision of irrigation water for the benefit of agricultural activities.

Although herding and fishing activities were practised, agriculture was the main economic activity in ancient Egypt (Lewis, 2009). Therefore, the Chief Minister, the second in command to the Pharaoh and the head of the Egyptian bureaucracy, was in charge of the supervision of the Nile. He used to receive a daily report on the Nile water level and reports from the governors of provinces on the state of irrigation and agricultural crops and, based on that level, agricultural tax was determined annually (Al-Kadi, et al., 1987). Moreover, the state officials measured and reassigned the land after every inundation, evaluated the expected crops, collected part of the produce as taxes, stored and redistributed it (Lewis, 2009). These agricultural taxes were decided based upon the level of the Nile flood which in turn determined the quantity of agricultural production. State bureaucracy was also in charge of public works. The governors of each province were in charge of the irrigation administration. Their duties included the supervision of canal digging, construction of bridges and the maintenance of irrigation basins and drainage (Al-Kadi, et al., 1987).

The successive rulers and colonisers of Egypt maintained the central role of the state bureaucracy in the irrigation water sector (Hamdan, 1967). Moreover, the Greek, Roman and the Muslim rulers of Egypt maintained the same regime with the same evaluation criteria that used the level of the Nile flooding to determine the

amount of taxes to collect from farmers until the beginning of the twentieth century (Elmusa, 1991). The level of efficiency of this bureaucracy was the main determinant not only of the success of irrigation and agriculture but also of the whole Egyptian economy. As Napoleon (quoted by Moret (1927, p. 34) stated during his reign in Egypt at the beginning of the nineteenth century:

> *In no other country has the administration so much influence on public prosperity. If the administration is good, the canals are well dug and well kept up, the regulations on irrigation are carried out justly, and the inundation reaches far. If the administration is bad, corrupt, or weak, the canals are blocked with mud, the dikes are badly kept up, the regulations on irrigation are disobeyed, and the principles of the system of inundation are thwarted by the sedition and private interests of individuals and localities. The Government has no influence on the rain or snow which falls in Beauce or Brie, but in Egypt the Government has direct influence on the extent of the inundation which takes their place. That is what makes the difference between the Egypt governed by the Ptolemies and the Egypt already decaying under the Romans and ruined by the Turks.* (Moret, 1927, p. 34)

However, although the efficiency of this bureaucracy has fluctuated between the different phases of Egyptian history, as indicated by the above statement of Napoleon, the public provision and management of water from irrigation have been maintained as the main informal institution of the Egyptian bureaucracy.

1.5.2 Microgovernance Institutional Structure

The irrigation system maintained its prominent and central position in the Egyptian government during the nineteenth century. The government continued its inherited monopolistic structure of water provision. In spite of this monopolistic structure, the government was able to raise the efficiency of the irrigation sector. To understand the structure of the Egyptian irrigation system and the reasons behind its improvement, it is imperative to explore first the structure of the government during this period.

Before the British colonisation, Egypt's official head of state was the Sultan of Turkey, represented by the Khedive, a position that was held by a member of

Mohamed Ali family. Upon the British colonisation of Egypt in 1882, the British High Commissioner, who had the rank of minister plenipotentiary in the British Foreign Service, presented a higher layer of real authority in Egypt. The Khedive had the power to reject the decrees of the Council of Ministers as long as his veto did not conflict with the advice of the British High Commissioner (Johnston, 1903). Since each ministry had a British undersecretary dictating its policies, the bottom and the top layers of authority were in the hands of the British. Therefore, the state had three heads: the Turkish sultan who was only the theoretical head of state, the Egyptian Khedive who was absolute monarch but had little power in reality, and the British who had the real authority in the country.

The Ministry of Public Works was established in 1864 to administer irrigation, agriculture and public constructions (Al-Kadi, et al., 1987). One of the main goals of the British government was to guarantee Egyptian exports, especially cotton, to its territories. Therefore it intensified its control over the Ministry of Public Works which governed irrigation in Egypt. Like other ministries, the Public Works ministry had a British undersecretary. Moreover, the ministry had three other British officials: an inspector-general of irrigation, an inspector of irrigation for northern Egypt and another for southern Egypt, and an inspector-general of reservoirs (Johnston, 1903). There were four other Egyptian heads of departments dealing with irrigation who were theoretically of the same rank as the British inspectors but practically they had less authority. Egypt was divided into six irrigation districts, known as circuits. The directors of three of these circuits were English and the other three were Egyptians. The subordinate inspectors and officials were mostly Egyptians. The inspectors were in charge of cleaning canals, building smaller diversion works, repairing masonry structures, keeping gauge heights on the Nile and on canals, and dividing the 'water among canals in accordance with the area under each or as the inspector-general may otherwise instruct' (Johnston, 1903).

The law of 1885, as noted above, left the authority wholly to the Director-General of Irrigation and authorised him to take decisions in times of water scarcity at his personal judgement to maximise the revenue of the state (Johnston, 1903).

Moreover, it put no restrictions on irrigation officials closing or opening irrigation canals. Under this regulation, a canal may be favoured or blocked in a season depending on whether it would serve for the irrigation of the more valuable crops. The farmers had no recourse to appeal against the actions of irrigation officials or if their water supply failed except to appeal for a partial or full remission of taxes (Johnston, 1903).

In contrast to irrigation water which was wholly publicly provided, drinking water was far from public provision. Moreover, only three cities started to enjoy private provision of drinking water in the 1860s. Two modern water companies were established to provide the urban parts of Cairo, the capital of Egypt, and Alexandria, the second biggest city in the country, with drinking water. At the same time, a freshwater canal was constructed to supply the Suez Canal area. This canal was operated by the French-British Suez Canal Company, alongside the Suez Canal itself, to supply the Suez Canal cities: Port Said, Suez and Ismailia (Fay, 1991). The company also used this canal for irrigating newly cultivated land surrounding the Suez Canal project (Fay, 1991). The rest of the country and even the poor areas in these cities, continued to rely on their primitive means to access drinking water.

In conclusion, water provision during this period was divided into two main sectors. The first was the irrigation water sector which was monopolised by the government. The second was the drinking water sector, which was totally privatised but its provision was limited to very few urban centres. Although the irrigation water was publicly provided, the sector witnessed radical reforms that led to significant improvements in its efficiency and performance. The main driver of these reforms by the regime was to increase the revenue of the treasury. Therefore, taxes were set to act as a water pricing mechanism. Although this price was relatively high, peasants had to bear it as agriculture was the only means of livelihood at that time. Moreover, since most of the production was exported, the government had to maintain the quality of its irrigation system to guarantee a production that can compete in the foreign markets. Therefore, although the irrigation water was subject to public provision, it escaped from the low-level equilibrium that usually characterises such publicly monopolised provision systems. The government

succeeded in establishing a high-level equilibrium that combined a high-quality provision system and highly-priced water provision.

1.5.3 Individual Level

In general, improvements in Nile water utilisation resulted in very limited benefits to most Egyptians during the nineteenth century. The Egyptian economy gained significantly from the improved use of the Nile water. However, the impact of this improvement on enhancing the capabilities of the ordinary Egyptian was very limited.

The inherited landholding pattern of the medieval order in Egypt was broken by Mohamed Ali at the beginning of the nineteenth century. He confiscated the feudal lands of the Mamluks, the previous rulers of Egypt, and farms of religious institutions in Cairo (Lewis, 2009). As a result, he became the owner of a significant part of the agricultural land of Egypt at that time. Consequently, he ordered the majority of Egyptian farmers to plant a new strain of high quality cotton to be exported to the British manufacturers of textiles (Lewis, 2009). He established a personal monopoly system by which peasants sold him their entire crops and consequently he sold it to textile manufacturers (Lewis, 2009). He created state monopolies over the main products of Egypt. Moreover, his radical changes were not limited to irrigation and agriculture, but were also extended to include the construction of roads, bridges, railways, ports and even telegraph lines to service cotton production (Fay, 1991).

These reforms led to a continuous increase in both the area of cultivated land and the intensity of cropping on this land (Table 6-1). This increase was due to the accelerating growth and transformation in perennial irrigation. This enabled the government to keep agricultural production in pace with the growing population. Therefore, the government was able to maintain the cropped area per capita at a constant rate of around 0.73 *feddans*[2] per 1000 persons in spite of population growth, thus maintaining the same basic living standards of the Egyptian people.

[2] A feddan is a unit of measurement of the land area in Egypt and Sudan. 1 feddan equals 0.42 hectares.

	Estimated Population (millions)	Cultivated area (1000 feddans)	Per capita cultivated area	Cropped area (1000 feddans)	Cropping intensity (%)	Per capita cropped area
1821	4.230	3053	0.73	3053	100	0.73
1846	5.290	3746	0.71	3746	100	0.71
1882	7.930	4758	0.6	5754	121	0.72
1897	9.717	4943	0.53	6725	136	0.71

Table 6-1: Cotton production in Egypt in the nineteenth century (Waterbury, 1979).

As a result, agricultural production witnessed a significant increase during the nineteenth century, especially the production of cotton. This increase in cotton production during the second half of the nineteenth century was also supported by the negative consequences of the American Civil War on American cotton production. Therefore, cotton production rose by more than ten times during the period; from 600,000 *kantars* in 1860 to 6,440,000 *kantars* by 1900 (Chesworth, 1994). However, the growth of agricultural production was constrained by the limits of the natural flow of the Nile water that Egypt was receiving by the end of the nineteenth century (Chesworth, 1994). Nevertheless, it should be noted that during the second half of the nineteenth century Egypt experienced a wave of modernisation. In the agricultural sector: 112 canals with a total length of 13,440 kilometres and 400 bridges were constructed, 480 kilometres of railway lines were laid and telegraph lines were extended for a total length of 8000 kilometres. Cairo and Alexandria were supported by public services such as water distribution networks, street lighting and postal services. Education was organised and expanded (Fay, 1991). More specifically, efforts were made to promote education and the study of medicine among the upper classes of the urban population (Lewis, 2009).

Although irrigation and agriculture witnessed significant improvements, the Egyptian people did not benefit much from it. Mohamed Ali carried out his reforms as if he were the owner of all the land and water in Egypt. Individuals were

considered as having no rights and were treated as a revenue-producing body (Johnston, 1903). Farmers were now allowed to dispose of pieces of land of between 2 and 6 acres but without having formal titles of ownership. The lack of title and the heavy weight of taxation made government the real owner of land. Individual farmers had no guarantee of the amount of water they would receive each year as the government decided water distribution according to its revenue logic. The long-established link between the state of the Nile flood and the amount of water each farmer received was broken by the monopolistic state that was deciding for its own interest. During seasons of water scarcity, irrigation officials enforced rotation aiming to save the more valuable crops to insure the maximum treasury revenue through taxation rather than aiming at protecting farmers uniformly (Johnston, 1903). Therefore, death as a result of malnutrition was not uncommon among the citizens. Moreover, forced labour became the norm when labour was wanted for any irrigation project, such as excavating canals or building irrigation structures. For example, it was estimated that more than 100,000 Egyptian died or were lost during the excavation of the Suez Canal. However, in 1870, during Ismail's reign, titles were granted for a small segment of farmers to mobilise resources for meeting Egypt's public foreign debt. Unfortunately, the law was considered unfeasible and was repealed in 1880. Although the state had used part of the agriculture sector revenue to modernise the country, the benefit of such efforts had not reached the majority of Egyptians. The benefits of the modernisation of Cairo and Alexandria benefited the upper class and upper middle class of Egypt who lived in these two cities. Similarly, since health care and education were not freely provided the benefits of the improvement of these sectors benefited only the same social classes.

In summary, the positive impact of improvement of the utilisation of Nile water on enhancing the capabilities of most Egyptians was limited. Only the upper social classes living in the urban centres of Cairo and Alexandria had access to safe drinking water. Similarly, although the agriculture sector was widely commercialised, the benefit accrued mainly to the ruling elite. Therefore, peasants continued to practise subsistence agriculture. Moreover, working conditions worsened for many Egyptians with the introduction of forced labour. Finally, the

enhancement of the capability of Egyptians to have access to knowledge through education and access to health care services was limited to the high and upper middle class because of the costs of accessing them.

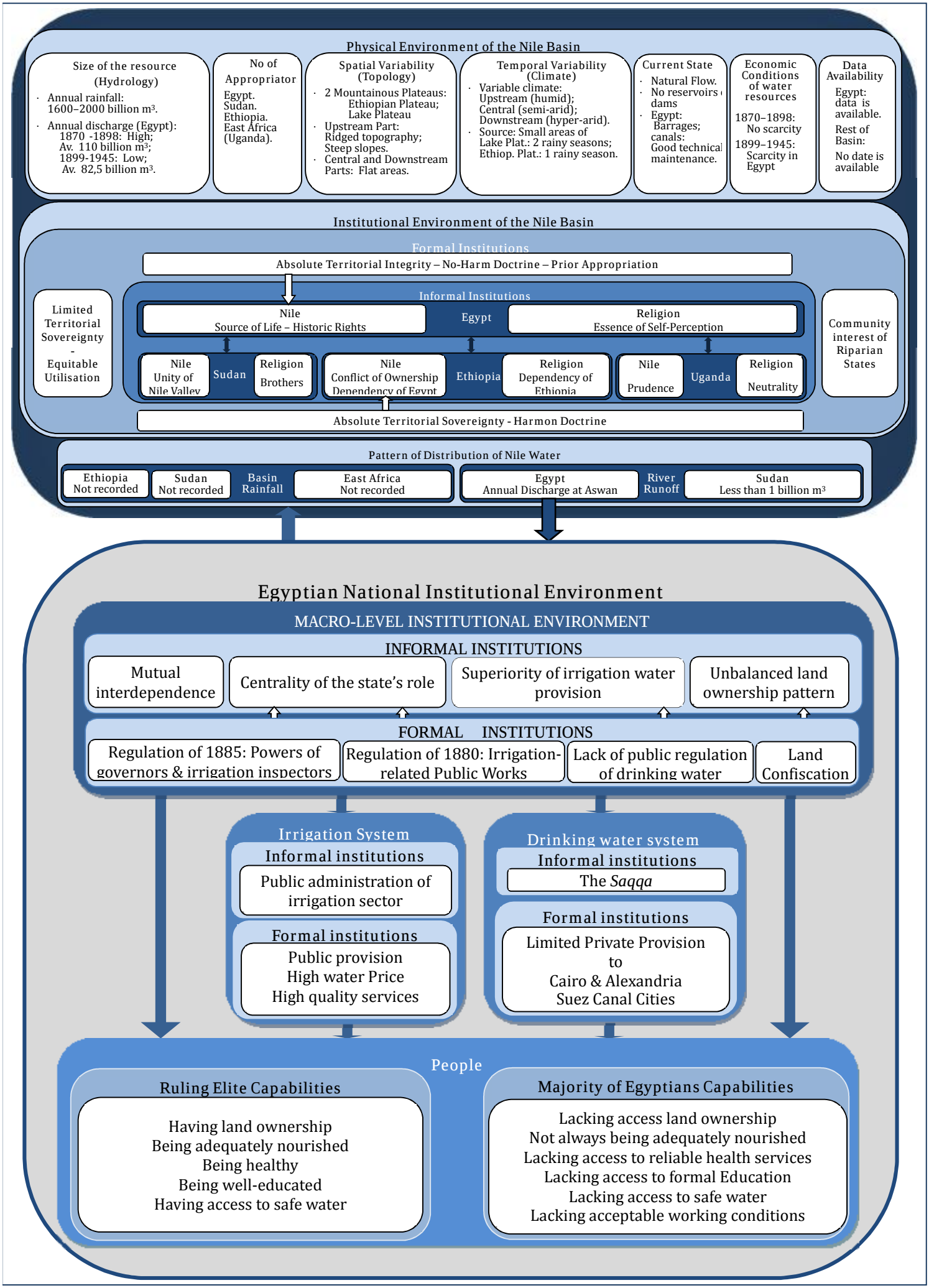


Diagram 6-6: Institutional structure of the Nile Basin – Egyptian National Institutional Environment

2 Institutional change: 1882–1954

The most important feature of the institutional changes in this period is that strategic institutional interactions in the Nile Basin were not conducted mainly by the Nile riparian countries. Until the nineteenth century, the importance of the Nile was limited to people who lived in its basin, specifically to the Egyptians and Nubians living in Northern Sudan (Collins, 1990). However, developments in the Nile Basin during the second half of the century attracted the major western powers to intervene heavily in the region. Therefore, the strategic interactions during this period were not limited to the countries of the Nile Basin but were shared by the dominant international powers at this time.

Three major events occurring mainly in the third quarter of the nineteenth century raised significantly the importance of the Nile to the major European powers: the discovery of the source of the Nile at the mouth of Lake Victoria in 1862; the opening of the Suez Canal in 1869; and the financial collapse of Egypt in 1876 (Collins, 1990). First, the discovery by John Hanning Speke that the source of the Nile flow is Lake Victoria attracted a great attention not only from European intellectuals but also politicians. The discovery of the source of the White Nile in the Equatorial Lakes by Speke in 1862 directed the western powers' attention to the link between Egypt's water resources and its neighbours in East Africa (Degefu, 2003). Second, the opening of the Suez Canal rendered the circumnavigation of Africa around the Cape of Good Hope route to reach the Far East uneconomical. The Suez Canal saved half the cost and the time of the journey from Europe to India. Last, the financial boom that Egypt enjoyed during most of the nineteenth century came to an end owing to the huge costs incurred by Khedive Ismail in his modernisation project of Egypt. By 1875, Egypt was indebted by 100 million pounds sterling. Although, Ismail had to sell the Egyptian shares to the British government, this did not save Egypt from declaring bankruptcy in 1876 (Collins, 1990). This financial collapse paved the way for foreign intervention in Egypt, resulting in the British colonisation of Egypt in 1882 which lasted until 1954.

The strategic games in the basin in this period were played at two levels: the international and the Nile Basin levels. The international level of the game was played among the international powers dominant in the region with or without the participation of the riparian actors. These international actors included Great Britain, Italy and France. This level encompassed the interactions among the western powers to serve their wider colonial interests of which the Nile represented only one element. The Nile Basin level of the game encompassed the strategic game over the Nile water from the perspective of the Nile riparian countries. This second level of the game was exercised by the riparian actors themselves. During this period the main strategic interaction took place among the first-level players. The basin level game was a part of the wider game and its result was derived from the wider general strategic game. Although the resulting institutional change of these games mainly affected the riparian countries, these second-level players were secondary, and sometimes absent, in these games. One of the main factors that drove the riparian actors to the margins of the strategic games was the lack of information and the weakness of the technical capacity of most of the riparian countries. Therefore, the games were driven mainly by the interests of the colonial powers which supported the implementation of the resulting agreements. Therefore, although negotiations were conducted partially by riparian countries from behind the veils of ignorance, it led to the establishment of institutional structures that were stable and enforceable by the dominant international powers (Waterbury, 2002).

The strategic institutional interactions can be divided into two groups according to the objective of each group. The first represents a phase of interactions aimed at establishing legal regulation of the distribution of the Nile water among riparian countries. The second represents another phase that sought to establish technical and legal regulation of the Nile water to increase the efficiency of its use.

2.1 Strategic Institutional Change: First Phase – Water Rights Allocation

The strategic interactions of Egypt during this period aimed at securing its historical senior water rights. To achieve this goal, Egypt and Great Britain had to secure the agreement of the other riparian countries of the Nile Basin to Egypt's senior water rights in the Nile. This was conducted through three main strategic interactions with Ethiopia, Sudan, and the upstream countries of the Equatorial Lakes, of which Uganda will be in focus in this study.

2.1.1 Egypt and Ethiopia

The Egyptian Nile receives waters from Ethiopia streaming from three basins: the Sobat-Baro-Akobo sub-basin (a joint sub-basin with south Sudan); the Blue Nile (Abbay) sub-basin and the Atbara-Tekeze sub-basin. One important thing to note is that Atbara-Tekeze sub-basin was part of the territories claimed by Ethiopia during this phase. Therefore, although this basin is mainly located in what has become the state of Eritrea since 1993, it was considered that Egypt and Ethiopia were the two countries concerned with the strategic interaction over this basin and the Atbara River. The hydrological relations between Egypt and Ethiopia represent the first action arena of our analysis. However, due to the fact that the Nile Basin was an arena for western competition, the Ethiopian-Egyptian action arena included two additional non-basin actors: Great Britain and Italy. During this phase, two action situations took place to regulate the waters that Egypt receives from Ethiopia. The first was conducted by Great Britain, acting for Egypt, and Italy, acting for Ethiopia or what was become to be Eritrea later, concerning the Atbara tributary of the Nile. The second was carried out by Great Britain, acting for Egypt and Ethiopia as an independent state concerning the Blue Nile and Sobat rivers.

2.1.1.1 Actors

2.1.1.1.1 Egypt

Egypt did not possess full statehood as it was part of the Turkish Empire then the British Empire. However, it was the most powerful actor because it enjoyed a well-established nationhood and strong bureaucracy rooted in its long history (El-Atawy, 1996). Moreover, the reform project led by the viceroy of Egypt, Mohamed Ali, then by his family, permitted Egypt to modernise its economy. However, since this modernisation project relied mainly on the agricultural sector, the Egyptian regime sought to secure permanently the water resources necessary for this sector.

Mohamed Ali was the first modern Egyptian ruler who attempted to extend his control over the sources of the Nile. He succeeded in attaching the territories of Sudan to Egypt in 1820. Consequently, he and his successors occupied some areas claimed by Ethiopia at that time, including Kassala (which now belongs to Sudan) in 1838, Massawa in 1846 (became part of Eritrea), Kunama in 1869 (divided between Eritrea and Ethiopia) and Harer (belong to Ethiopia) (Degefu, 2003). As indicated above, Khedive Ismail attempted to establish an Egyptian Empire that would include the sources of the Nile in Ethiopia and Lake Victoria to secure Egypt water resources (El-Atawy, 1996). Egypt succeeded in consolidating its empire on the East African coast of the Red Sea to include Sudan and Somaliland (El-Atawy, 1996). However, Egypt failed to conquer Ethiopia during the war that extended over 1875–1876 and had to sign a treaty with Ethiopia in 1884, named the Adwa or Hewett Treaty, to restore peace and normalise the relations between the two countries (Degefu, 2003). The failure of the attempt of Khedive Ismail to extend Egypt control over Ethiopia and equatorial lakes induced Egyptian government to seek the peaceful means to achieve its hydrologic security. Moreover, the costs of the modernisation project that that was led by Khedive Ismail consumed all the financial wealth accrued to the country during the reign of his predecessors. Therefore, Egypt fell into a crisis of financial collapse and foreign debts in 1876. This crisis paved the way to the British colonisation of Egypt in 1882.

However, although Egypt fell under the control of the British, its agricultural sector continued to grow as explained above. Therefore, the Egyptian government established two main objectives for its Nile Basin policy by the end of the nineteenth century: an immediate objective and another medium-term objective. The immediate objective was to secure the continuity of the Nile water flow that Egypt was receiving at that time. In other words, it aimed at securing the senior Egyptian water rights at that time. The medium-term objective was to increase and stabilise the Nile water flow to Egypt to meet the needs of the growing agricultural sector. During this first phase of strategic interactions, Egypt focused on securing its water rights.

2.1.1.1.2 Ethiopia

Although Ethiopia was the only riparian actor that enjoyed statehood at the end of the nineteenth century, it was fragile and internally divided (Waterbury, 2002). Therefore, its main objective was to strengthen its internal cohesion and to mobilise international recognition of its independence (El-Atawy, 1996). Moreover, it had neither the vision nor sufficient technological capacity to benefit from the Nile water.

Ethiopia struggled to maintain its independence throughout the nineteenth century. After a long period of division extending from the late seventeenth century to the middle of the nineteenth century, Ethiopia restored its unity in the hands of King Theodore II in 1855 (El-Atawy, 1996). One important historical development that helped Ethiopia to restore its unity was the treaty that was signed between Ethiopia and Great Britain in 1849. This treaty was considered as recognition of the independence of Ethiopia. In this treaty, both parties pledged themselves to keep open and secure the roads linking Ethiopia, or Abyssinia, and the sea coast (Degefu, 2003). The treaty also stated that commercial transactions between the subjects of Abyssinia and Great Britain would be promoted (Degefu, 2003). However, during the second half of the nineteenth century Ethiopia suffered from social unrest and faced severe confrontations with its neighbours and Great Britain (El-Atawy, 1996). During this period, although Ethiopia was officially governed by Emperor Yohannes,

the king of kings of Ethiopia, his power was concentrated more to the north while the centre of Ethiopia was controlled by the King of Shewa before he became the king of kings of Ethiopia in 1889. However, although the western powers competed over Ethiopia, they never succeeded in conquering it. Italy attempted to establish Ethiopia as an Italian protectorate in 1889 but this attempt failed and after a two-year war Ethiopia regained its independence in 1896.

Therefore, Ethiopia's major interests were to strengthen its internal cohesion and to expand its territories to include a port on the Red Sea (El-Atawy, 1996). Ethiopia was too weak to represent a threat in its own to the Egyptian and British interests, but its ties with other European powers alarmed the British (El-Atawy, 1996). Moreover, the technology of that time was not sufficient for Ethiopia to benefit from the waters of the Nile that originated from its lands. Therefore it had no clear objective towards the Nile except protecting its small local agricultural areas.

2.1.1.1.3 Great Britain

Although Great Britain's intervention in Egypt was motivated at the beginning by its interests in the Far East, it later developed genuine interests in the Egyptian agricultural sector that led its foreign policy in the whole Nile Basin. Therefore, it established an imperialist system that covered the whole Nile Basin to serve its economic objectives in Egypt. More specifically, the main objective of the system was to serve the Anglo-Egyptian hydrologic interests.

Great Britain considered India and the sea lanes to the Far East as major assets of its empire that needed to be protected from the encroachment of other western powers (Waterbury, 2002). Therefore, British Empire adopted an expansionist strategy that entailed extending its control over Egypt, Palestine, Sudan, and the Equatorial Lakes (Waterbury, 2002). Therefore, when the British government decided to occupy Egypt in 1882, its main interest was to control the Suez Canal which was considered as the highroad to the empire in the Far East (Tvedt, 2004). The strategic importance of Egypt was elevated by the construction of the Suez Canal and its opening in 1869 (Waterbury, 2002). However, over time

Great Britain discovered additional reason for reinforcing its position in Egypt, which was securing sufficient imports of Egyptian cotton to supply the textile industry in Manchester (Tvedt, 2004).

When the British occupied Egypt, they discovered that fact that Egypt was an old hydraulic society (Tvedt, 2004). The British rulers realised that providing water to Egypt meant imperial profits and national prosperity and political legitimacy (Tvedt, 2004). Since Egypt was reaching the limits of its water, Britain decided to expand southwards to secure the existing water sources and to attempt to increase them in the future (Tvedt, 2004). Therefore, Great Britain declared the whole Nile Valley its exclusive sphere of influence in 1890 to prevent other European powers from acquiring territories in the Nile Basin (Woldetsadik, 2013).

Although the British knew that most of the water of the Egyptian Nile came from the Blue Nile, they realised that the White Nile was more important for the cultivation of cotton in summer season and that it was technologically more difficult to control the silty Blue Nile, especially with the steep slopes of the Ethiopian lands (Tvedt, 2004). Therefore they focused more on the White Nile and its sources in the Equatorial Lakes.

Therefore, the British government held negotiations with the western powers in 1890–91 over east and north-eastern Africa, in which the British representatives focused on securing the water needs of Egypt (Woldetsadik, 2013). Therefore they put military and diplomatic pressure on the other major powers until they signed agreements securing British interests on the Nile Basin. Germany agreed with Great Britain in 1890 to withdraw claims on some areas adjacent to the Nile Basin (Woldetsadik, 2013). Similarly, France agreed to cease its efforts to establish a sphere of influence in the Nile Basin in 1899 (Woldetsadik, 2013).

However, Great Britain did not ignore securing its hydrologic interests in Ethiopia (Tvedt, 2004). When the Italian attempt to colonise Ethiopia failed, Ethiopia not only controlled the sources of the Blue Nile but claimed that its territories extended to the eastern banks of the White Nile. This was among the reasons that

induced Great Britain to conquer Sudan. The Anglo-Egyptian conquest of Sudan in 1898 ended the Ethiopian claims to extend its western borders as the White Nile became a part of the Anglo-Egyptian Sudan (El-Atawy, 1996). However, the British strategy replaced direct control interventions in Ethiopia by establishing a sphere of political and economic influence based on contracting agreements that prevented any interference with the hydrological integrity of the tributaries of the Nile originating in Ethiopia (Woldetsadik, 2013). The British preferred not to take control of the Ethiopian highlands themselves, but to secure their hydrological interests by preventing other major western powers from interfering with Nile flood (Tvedt, 2004). The British government permitted the Italian expansion on the eastern coast of the Ethiopian highlands, but when the Italians reached Kassala to control the Atbara tributary, the British reacted by deciding to confront the Italians by occupying two areas to adjacent Kassala, Suakin and Tokar, in February 1891 (Tvedt, 2004).

By the end of the century, the British imperialist strategists established a British Nile imperialist system, aimed at securing British interests. The cornerstone of this system was their conceptualisation of the Nile as a single hydrological and political unit (Tvedt, 2004). The system had a centre in London and peripheries with different relative importance and weight in the Nile Basin (Tvedt, 2004). Moreover, Britain had more than one actor in the Nile imperialist system. British actors included the government in London, the High Commissioner in Cairo and British officers in the relevant Egyptian ministries, Sudan Political Service, the colonial governor of Uganda as well as British diplomats in Addis Ababa (Tvedt, 2004).

The immediate objective of the British was to protect Egypt's irrigated agricultural sector (Waterbury, 2002). They also shared the Egyptian goal of achieving better control and management of the Nile water in order to increase agricultural production. Moreover, after the Anglo-Egyptian occupation of Sudan in 1898, the British government extended its geopolitical interests in the basin to include Sudan owing to its potential for cotton cultivation to supply the British domestic textile industry (Woldetsadik, 2013). Another secondary objective was the

transfer of the gold and coffee trades from south-eastern Ethiopia into Sudan (Waterbury, 2002).

2.1.1.1.4 Italy

The Italian colonial experience in East Africa was motivated and at the same time restricted by the internal economic pressures of Italy. Therefore, these pressures limited the Italian military capacity and hence weakened its control over Ethiopia. Moreover, the Ethiopian resistance to the Italian influence made the Italian regime in Ethiopia unstable. Therefore, that Italian goal was limited to mobilising the support of other western powers for its presence in East Africa.

As a late coloniser, Italy attempted to find a place in East Africa because it was not yet under fierce competition from other colonial powers. One of the main objectives of Italian imperialist strategy was to alleviate its population growth problem by creating new economic opportunities in the colonies to attract Italian migration to these areas (El-Atawy, 1996). Italy as a coloniser suffered from the lack of sufficient financial resources and military power. Therefore, it focused on East Africa as it was not claimed by other western powers at that time (El-Atawy, 1996). Moreover, Italy resorted to the strategy of clandestine civil operations to prepare for its colonisation of parts of East Africa. These operations took the form of religious, scientific and commercial missions to Ethiopia and other areas on the coast of the Red Sea over the 1870s and 1880s (Degefu, 2003). These operations achieved their objective when the Italian government bought the port of Assab, which was claimed to be part of the Ethiopian land at that time but is now part of Mauritania, in 1882 from an Italian company that owned it as part of its commercial area, and declared it to be an Italian colony. Although Great Britain pledged itself to secure roads linking Ethiopia to the Red Sea coast, it did not object to Italian occupation of the main areas linking Ethiopia with the sea to avoid a Franco-Ethiopian presence at these areas (Degefu, 2003). This paved the way for Italy to conquer Massawa in 1885 only a half year after the Egyptian forces left it (Degefu, 2003). Moreover, the Italians initiated diplomatic contacts with Emperor Yohannes to establish a contractual agreement guaranteeing the Italian interests in Ethiopia, but he did not respond positively to

their initiative (Degefu, 2003). After the death of Yohannes King Menelik II, the ruler of Shewa, declared himself Emperor of Ethiopia on March 25, 1889. A month later, Emperor Menelik signed a Treaty of Perpetual Peace and Friendship with Italy. This treaty was named the Treaty of Ucciali or Wuchale. It gave Italy control over Eritrea, the Red Sea coast to the north-east of Ethiopia, in return for recognition of Menelik's rule.

The treaty of Ucciali was not only the legal birth certificate of the Italian colony of Eritrea but also granted Italy the status of the protector of Ethiopia (El-Atawy, 1996). Article III of this treaty confirmed the legal existence of the Italian colony of Eritrea by defining a boundary line between Ethiopia and a coastal area under foreign sovereignty (Rubenson, 1964). Although Menelik II adopted a policy of integrating Ethiopia this treaty gave the Italians a foothold in the Ethiopian highlands (Rubenson, 1964). Most importantly, Article 17 of the treaty was used by Italy to establish itself as a protector of Ethiopia. This article of this bilingual treaty did not say the same thing in Italian and Amharic. The Italian version obliged Ethiopia to conduct all foreign affairs through Italian authorities, making Ethiopia an Italian protectorate. The Amharic version gave Ethiopia considerable autonomy, with the option of communicating with third powers through the Italians. Although the words 'protectorate' and 'protection' are conspicuously absent, there can hardly be any arguments about the implication of this clause. In the colonial thinking of the later part of the nineteenth century the establishment of a protectorate over an African territory was closely tied up with the exclusive right to conduct or control its foreign affairs (Rubenson, 1964). Therefore, once the treaty had been ratified, the Italian government notified the other colonial powers of the treaty with Ethiopia. The notification was accepted without reservation or even comment by most of the colonial powers. Although Menelik denounced the Italian version of the protectorate article, neither Italy nor the other powers made any move formally to end the protectorate state of Ethiopia (Giglio & Caulk, 1965). On the contrary, Italy continued to maintain its view and considered Ethiopia as the Italian sphere of influence. Theoretically, the protectorate existed until the date of the signature of the Treaty of Peace after the defeat of Italy in the Adwa war in 1896. However, the continuous

Ethiopian struggle weakened the Italian presence and induced the Italians to seek the diplomatic support of other western powers.

In summary, Italy attempted to establish a colony in East Africa to alleviate its internal economic pressure. It succeeded in establishing the Italian colony of Eritrea. Moreover, it used the treaty of Ucciali to establish Ethiopia as an Italian protectorate. However, the conflict between the Ethiopian Emperor and Italy over interpretations of the text of the Treaty of Ucciali made the Italian presence in East Africa unstable. Therefore, the Italian objective was to secure its potential imperial project in East Africa. Italy did have not enough military and political power to compete with Great Britain over the Nile water.

2.1.1.2 Action Situation of 1891

As explained above, the formal inter-state institutional framework made the assignment of water rights a pressing issue for Egypt at the end of the nineteenth century. Although Egypt was reaching its water limits owing to its increasing agricultural production, it had first to secure its actual uses of water before initiating its efforts to increase its Nile water resources. Therefore, Egypt became engaged, directly or indirectly, in a series of action situations aimed at securing Egypt's water use at that time. The first of them occurred in the beginning of the last decade of the nineteenth century between Great Britain and Italy.

2.1.1.2.1 Setting: Demarcation of Spheres of Influence in Eastern Africa

Although the action situation of 1891 mainly affected the interests of Egypt and Ethiopia, it was carried out by two other participants: Great Britain and Italy. This situation led to the demarcation of the spheres of influence of Great Britain and Italy over Ethiopia. Ethiopia was divided into parts: the Ethiopian part which included the Blue Nile (for simplicity we denote it Blue Nile Ethiopia (BN-ETH)), and the coastal part of Ethiopia which later became Eritrea (for simplicity we denote it as ERT-ETH). Blue Nile Ethiopia (BN-ETH) was considered more rich and valuable in terms of resources than the Eritrean part (ERT-ETH).

The positions of the participants in this situation were related to their wider position as colonising powers in Africa. The position of Great Britain in this strategic situation was as de-facto protector of Egypt. Italy's participation was part of its late colonisation adventure in East Africa; i.e. the coloniser of the coastal part of Ethiopia. As protector of Egypt, Great Britain was mainly concerned with the security of Nile water resources that Egypt was using to serve the British textile industry. The first available British action was to maintain the status quo as established by the declaration of 1890 which declared the whole Nile Valley as its sphere of influence. The second potential action was to concentrate on the Blue Nile, which provides the Egyptian Nile with most of its water. In other words, Britain's second option was to limit its sphere of influence to the Ethiopian part that included the Blue Nile. It

should be noted that the White Nile and Sobat River are located to the west of the Blue Nile. Therefore, Great Britain got the area of western tributaries, Sobat River and White Nile, when it delimited the eastern border of its sphere of influence by the Ethiopian part that contains the Blue Nile. In this way, Great Britain could guarantee the economic benefits of the Blue Nile, the White Nile and Sobat River for the British textile industry. Only the Atbara River would be excluded in this case. Similarly, Italy had two options to increase its economic benefits from its colonisation adventure in East Africa. The first available action would be to maintain its actual sphere of influence to the coastal part of Ethiopia. This option would partly meet its economic objectives. The second potential action was to act more aggressively to increase its economic gains. This would be achieved by extending its sphere of influence from the coastal part of Ethiopia to include the cities that control the Atbara River.

Participant	Position	Possible actions
Great Britain	Protector of hydrological interests of Egypt.	Maintaining the status quo, in which the Nile Valley was established as its sphere of influence.
		Limiting its sphere of influence to the Blue Nile and the Sobat as a British sphere of influence and excluding the White Nile.
Italy	Coloniser of coastal part of Ethiopia	Maintaining the status quo which was the establishment of the coastal part of Ethiopia, excluding the Nile tributaries, as its sphere of influence.
		Extending its sphere of influence of influence, the coastal part of Ethiopia, to include the White Nile.

Table 6-2: Structure of action situation of 1891.

2.1.1.2.2 Formal analysis

Following the analysis by Ostrom (1994) of fishing games, there were four possible outcomes of this game. The first would be the eruption of a conflict between Great Britain and Italy over influence on the Atbara River. The second possible outcome would leave the Atbara River as a vacuum without including it in any of the spheres of influence of the two powers. The two other options would entail one participant ceding the Atbara River from its sphere of influence to the other participant.

Clearly, the strategy of each participant would depend not only its valuation of the benefits of the payoff of each outcome but also on its chances of getting this outcome. In other words, each would use a mixed strategy based on the expected payoff of each outcome. With regard to the British, it is clear that the value to Great Britain of the option of maintaining the whole Nile Valley as its sphere of influence ($V_{GB\text{-}N}$) was higher than limiting it to the Blue Nile and the western tributaries of the Nile ($V_{GB\text{-}BN}$). Similarly, Italy would value the payoff that would entail extending its sphere of influence that included the Eritrean part of Ethiopia to include the Atbara river ($V_{It\text{-}(ERT+Atb)}$) higher than maintaining the Eritrean part of Ethiopia without control over the Atbara River ($V_{It\text{-}ERT}$). This can be represented formally as follows:

$$V_{GB\text{-}N} > V_{GB\text{-}BN} \quad (6.1)$$

$$V_{It\text{-}(ERT+Atb)} > V_{It\text{-}ERT} \quad (6.2)$$

Moreover, we denote the cost of the mobilisation of a military campaign for both participants in a conflict as C. However, the Italian occupation of the coastal part of Ethiopia demonstrated that C was smaller than $V_{IT\text{-}ERT}$. Similarly, we denote the damage to the loser of the confrontation as D. Since Great Britain had stronger military capacity and political power, the probability that Great Britain would win any confrontation against Italy was greater than 0.5:

$$P_{GB} > 0.5. \quad (6.3)$$

Denoting $P_{GB} = P$ (6.4)

Then $P_{It} = 1 - P_{GB} = 1 - P < 0.5$ (6.5)

		Italy	
		Eritrea + Atbara	Eritrea
Great Britain	Nile	W(GB, N) , W(It, ERT+Atb)	V_{GB-N} , V_{ERT}
	Blue Nile	V_{GB-BN}, $V_{It-(ERT+Atb)}$	V_{GB-BN} , V_{ERT}

Table 6-3: Game matrix of action situation of 1891.

Only the payoffs in case of confrontation need to be calculated as the payoff of players in case of the choice of different location is direct. From what has been indicated, the payoff of the players can be calculated as follows:

The payoff to Great Britain in case of confrontation over the Atbara River (BN-ETH):

$$W(GB, N) = P * V_{GB-N} + (-C) + (1-P) * (-D) \quad (6.6)$$

The payoff to Italy in case of confrontation over the Atbara River (BN-ETH):

$$W(It, ERT+Atb) = (1-P) * V_{It-(ERT+Atb)} + (-C) + (P) * (-D) \quad (6.7)$$

Bearing in mind that Italy resorted to the colonisation of East Africa because of the gap between its military capacity and the rest of the colonial powers, and that Great Britain was the strongest colonial power, it is reasonable to assume that the balance of power between Britain and Italy was very uneven, in other words, P is assumed to be very close to one, i.e.:

$$P \simeq 1 \quad (6.8)$$

Then

The payoff to Great Britain case of confrontation over the Blue Nile Ethiopia (BN-ETH) represented by equation (6.6) could be simplified to the following:

$$W(GB, BN) = V_{GB-N} - C \quad (6.9)$$

The payoff to Italy in case of confrontation over the Blue Nile Ethiopia (BN-ETH) represented by equation (6.7) could be simplified to the following:

$$W(It, BN) = - C - D \quad (6.10)$$

Therefore the strategic game will take the following form:

		Italy	
		Eritrea + Atbara	Eritrea
Great Britain	Nile	$(V_{GB\text{-}N} - C)$, $(-C - D)$	$V_{GB\text{-}N}$, V_{ERT}
	Blue Nile	$V_{GB\text{-}BN}$, $V_{It\text{-}(ERT+Atb)}$	$V_{GB\text{-}BN}$, V_{ERT}

Table 6-3: Game matrix of action situation of 1891.

As indicated by Table 6-4, the evolution of the game depended more on the preferences of Great Britain. The preferences of Italy were very clear. Italy would prefer to maintain Eritrea without control over the Atbara River than lose a confrontation with Great Britain at a cost of (-C –D). Moreover, it would prefer to extend its control over the Atbara river $V_{It\text{-}(ERT+Atb)}$ if Britain ceded the control over it voluntarily. On the other hand, the preferences of Great Britain were not clear until a short period before negotiations over this treaty. Clearly, Britain would prefer to maintain its sphere of influence covering all the Nile sources including Atbara if Italy ceded control over it. However, it was not clear whether it would prefer confronting Italy to maintain the Atbara River within its sphere of influence over limiting its control over the Blue Nile and western tributaries to avoid this confrontation.

		Italy →	
		Eritrea + Atbara	Eritrea
Great Britain	Nile	$(V_{GB\text{-}N} - C)$, $(-C - D)$	$V_{GB\text{-}N}$, V_{ERT}
	Blue Nile	$V_{GB\text{-}BN}$, $V_{It\text{-}(ERT+Atb)}$	$V_{GB\text{-}BN}$, V_{ERT}

Table 6-4: Game matrix of action situation of 1891.

Therefore, this situation could develop in two ways depending on the preferences of Great Britain towards confrontation and the value of the Atbara River. If Britain preferred to limit its sphere of influence to the Blue Nile and the western tributaries of the Nile instead of confronting Italy over influence over the Atbara river:

$$V_{GB\text{-}BN} > V_{GB\text{-}N} - C \qquad (6.11)$$

then the game would take the form presented in Table 6-5.This game would have two possible equilibriums at ($V_{GB\text{-}BN}$, $V_{It\text{-}(ERT+Atb)}$) and ($V_{GB\text{-}N}$, V_{ERT}). At the equilibrium ($V_{GB\text{-}BN}$, $V_{It\text{-}(ERT+Atb)}$) Great Britain would cede control over Atbara to Italy to avoid confrontation over this river. At this equilibrium ($V_{GB\text{-}N}$, V_{ERT}), Great Britain maintains a sphere of influence that covers all the sources of the Nile, including the Atbara, while Italy maintains its control of Eritrea with the exception of the Atbara.

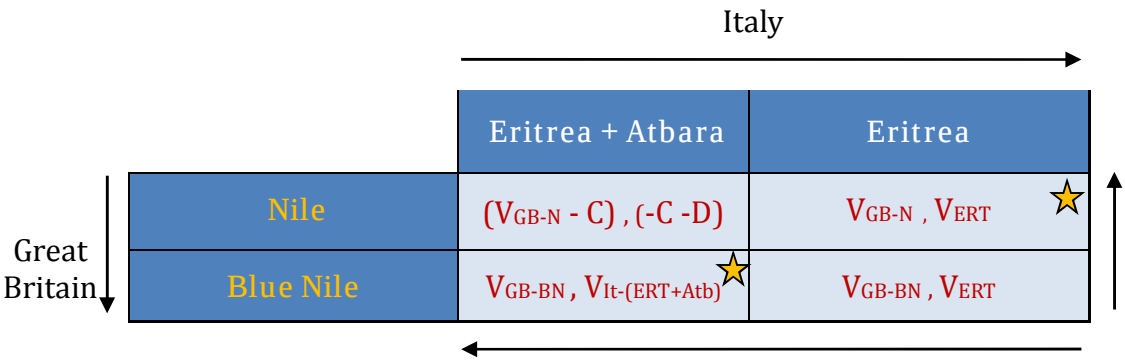


Table 6-5: Game matrix of action situation of 1891- Possible equilibriums.

The other case of the game would occur if Britain preferred to maintain its control over the sources of the Nile including the Atbara even if it cost it the use of force, i.e.:

$$V_{GB\text{-}N} - C > V_{GB\text{-}BN} \qquad (6.12)$$

In this case, the game would take the form presented in Table 6-6. This game has one equilibrium at ($V_{GB\text{-}N}$, V_{ERT}). At this equilibrium Great Britain maintains a sphere of influence that covers all sources of the Nile, including Atbara, while Italy maintains its control of Eritrea with the exception of the Atbara.

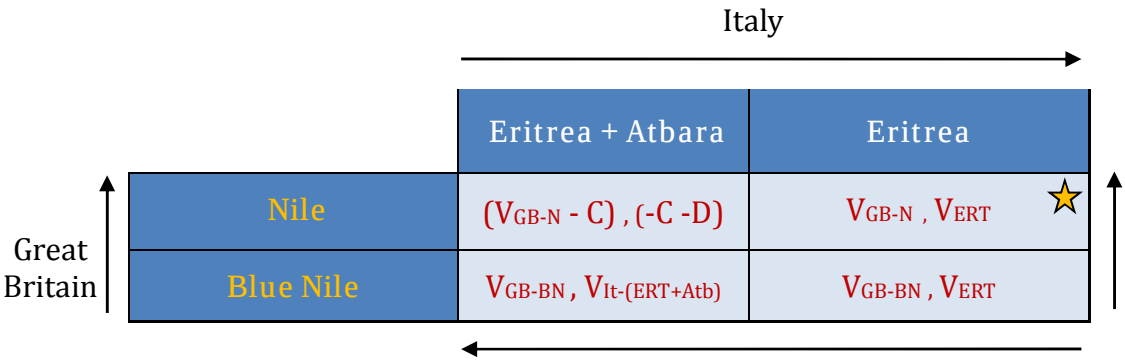


Table 6-6: Game matrix of action situation of 1891- Equilibrium.

Since Great Britain was very selective in its military interventions in Africa in general, and in East Africa in particular, both patterns of British preferences were probable. Therefore, Italy decided to make a strategic move to signal its commitment to pursue its control over the Atbara River by attempting to extend its military operation to reach Kassala and a foothold on the Atbara river (Tvedt, 2004). This strategic move of Italy could be considered as a 'salami' tactic or graduated transgression to the British sphere of influence aiming at transgressing more, step by step, if the British ignored it. However, the British government opposed the Italian attempt. Moreover, as a counter move, the British government approved a military operation to occupy two adjacent cities, Suakin and Tokar, as a graduated threat to occupy the Atbara river surroundings if Italy continued its attempt (Tvedt, 2004). This counter move threat of graduated British response not only revealed the British preference for maintaining its sphere of influence over all sources of the Nile including the Atbara river, but also represented a graduated threat of breaching the Italian control of the coastal part of Ethiopia if Italy insisted on its attempts to control any part that included any of the sources of the Nile.

Therefore, the game took the form of the chicken game with one equilibrium ($V_{GB\text{-}N}$, V_{ERT}), which is depicted in Table 6-6. Therefore, Italy halted its attempt to occupy Kassala and entered into negotiations that led after one month to the signature of the treaty of 1891 on the demarcation of spheres of influence in Eastern Africa between Great Britain and Italy. In this chicken game, Britain resorted to a

graduated threat to reveal its preferences and declared its intention to play tough. This permitted Britain to maintain its sphere of influence over all the sources of the Nile including the Atbara level while it recognised the Italian occupation of Eritrea as a credible promise not to breach the Italian control over Eritrea in the future. This agreement was formalised in a treaty.

2.1.1.2.3 Results

The treaty of 1891 was formalised in two protocols. The first was signed at Rome on 24 March 1891 and demarcated the spheres of influence between Great Britain and Italy. The second was also signed at Rome on 15 April 1891. This second instrument reaffirmed the demarcation of the spheres of influence but more importantly it detailed the distribution of benefits of the Italian colony of coastal Ethiopia, including control over the Atbara River, between Great Britain and Italy.

The treaty of 1891 permitted Italy to colonise the coastal part of Ethiopia, which later became Eritrea, in return for guaranteeing the Egyptian interest of securing its normal flow of the Nile water (El-Atawy, 1996). In the first protocol, Britain recognised the Italian protectorate of Ethiopia, Eritrea, but delineated the borders of Ethiopia to include the whole Blue Nile as beyond Italian control (El-Atawy, 1996). On the other side, Italy recognised the sphere of influence over the Blue Nile and the western tributaries of the Nile. However, this left the future of the control of the Atbara River undecided. It is not clear if it was left intentionally to the negotiations of the second protocol or if it was raised after the signature of the first protocol, leading to the negotiations over the second protocol.

In the second protocol, Great Britain reinforced its previous recognition of the Italian control over Ethiopia (Degefu, 2003). Moreover, Italy was granted the possibility of operational occupation of Kassala conditioned on not constructing any works that could affect negatively the Nile flow (Woldetsadik, 2013). More specifically, Britain permitted the Italian presence in Kassala as a military need while it received Italian recognition of Egyptian sovereignty over Kassala with an Italian pledge to return it to Egypt when it had restored the control over Sudan (El-Atawy,

1996). On the other hand, Article III of this protocol, which was formulated in French, set limitations on the control of the Atbara River by the Italian protectorate of Ethiopia, i.e. coastal Ethiopia. This article stipulated that "the Italian Government undertakes not to construct on the Atbara, for irrigation purposes, any works which might sensibly modify its flow into the Nile" (International Law Commission, 1974). In this way, Great Britain succeeded in acquiring Italian recognition of its sphere of influence over the whole Nile Basin, including the Atbara River, in return for recognising formally the Italian colonisation of the coastal part of Ethiopia.

2.1.1.3 Action Situation of 1902

Upon securing its influence over the Atbara River, Great Britain needed to secure its influence over the Blue Nile and the Sobat. However, the evolution of the relations between Italy and Ethiopia postponed this settlement until the beginning of the twentieth century. The dispute over the treaty of Ucciali led to a two-year war between Italy and Ethiopia. Since the Ethiopians won this war and restored their independence, Great Britain had to negotiate for the first time a settlement over Nile water with one of the riparian countries. This process of negotiation started with a series of communications and economic agreements that led finally to the treaty of 1902 that aimed at delimiting the borders between Sudan and Ethiopia and included an article that addressed the Blue Nile and Sobat tributaries of the Nile.

2.1.1.3.1 Setting

Disputes over Article 17 regarding the conduct of foreign affairs led to the First Italo-Ethiopian War. The renunciation by King Menelik II of the whole treaty of Ucciali in 1893 led to a major military confrontation with the Italians in the Battle of Adwa in 1895–1896 (Tvedt, 2004). The Ethiopian victory in the battle of Adwa confirmed their ability to preserve their independence (Degefu, 2003). The outcome of the battle resulted in cancellation of the treaty of Ucciali and the recognition of the sovereignty of Ethiopia in return for leaving what has come to be known as Eritrea to the Italians (Tvedt, 2004).

Great Britain signed a treaty of commerce and amity with Ethiopia in 1897, in which King Menelik pledged neutrality towards the Anglo-Egyptian occupation of Sudan in return for British support for his regime and his efforts to maintain the unity of Abyssinia (Tvedt, 2004). In March 1902, Britain and Ethiopia exchanged diplomatic notes confirming Ethiopia's oral pledge that "there is to be no interference with the flow of the Blue Nile or Lake Tana except with the consultation of His Majesty's Government" and if there be interference "all conditions being equal, preference will be given to the proposals of His Britannic Majesty's Government; and that His Majesty the Emperor Menelek has no intention of giving any concessions

with regard to the Blue Nile and Lake Tana except for His Britannic Majesty's Government, the Government of Sudan or one of their subjects" (London: Foreign Office Archives, FO 403/ 322).

The main feature of this game was that it combined riparian and non-riparian participants. Therefore, the participants who engaged in this action situation had different positions. On one side, Great Britain maintained its position in the action situations over the Nile water as a de-facto protector of the hydrological interests of Egypt. On the other, Ethiopia was a riparian country which had recently resisted colonisation and affirmed its independence. However, both participants in this action situation had something in common, which was the desire for recognition of their positions.

Great Britain declared the Nile Basin as its sphere of influence. Moreover, it protected most of its hydrological interests, which included by that time the interests of Egypt and Sudan, in the Nile water, either by military occupation as was the case in the sources of the White Nile or by bipartisan agreements as was the case with the Atbara River. However, the defeat of Italy in the battle of Adwa and its recognition of the independence of Ethiopia left Great Britain without any contractual guarantee of its interests in the Blue Nile originating from the Ethiopian territories. Furthermore, the failure of Italy to conquer Ethiopia had warned the other western powers of the high risk of military intervention in Ethiopia owning to its severe topography. Therefore, Great Britain needed a contractual guarantee from the Ethiopian regime that could secure its interests in the Nile water.

Similarly, Ethiopia had a de-facto full statehood that was recognised by Italy in the treaty of Adwa in 1896. Nevertheless, the Ethiopian regime suffered from internal division and foreign threats. This division raised the threat of the alliance of opposing regions or rebel groups with any of the major western colonial powers. Great Britain seized the opportunity of the Italian defeat to support the Emperor of Ethiopia against the French ambitions and Italian demands as well as the Egyptian historical claims to its territories (Tvedt, 2004). This British support was aimed at obtaining the support of the emperor for the British Nile policy (Tvedt, 2004).

However, the Ethiopian regime needed not only this British support but also a formal recognition of the sovereignty of Ethiopia and its legitimacy in power. On the other hand, as explained above, the Ethiopian interests in the Blue Nile were severely limited by topography and technology to some small localised irrigated agricultural areas. Therefore, the economic value of the Blue Nile at that time was very low in comparison with the security threat to the Ethiopian regime at that time.

2.1.1.3.2 Formal Analysis

The positions and the preference of the British and Ethiopian participants in the situation determined their possible action in the strategic game. Since both parties needed a guarantee of their interests, the feasible option for them was the mutual recognition of their interests. However, unless each part guaranteed the recognition of the other, both actors might have preferred to maintain their unregulated situation.

This mutual recognition would not only guarantee each participant's interest vis-à-vis the other participant, but would also support their claims in front of the third parties. In other words, it would strengthen the British claims against other western powers in the region. At the same time it would strengthen the legitimacy of the Ethiopian regime and guarantee it British support against local challengers and foreign colonial powers. Therefore, the first available British action was to recognise Ethiopian independence with the aim that this would be met by a similar Ethiopian recognition of its interests in the Blue Nile and the Sobat rivers. The second possible action was to stick to the status quo of the unilateral declaration of 1890, which established British influence over the Nile Basin including the Blue Nile and Sobat. Similarly, Ethiopia could recognise the British influence over the Nile hoping that the British government would recognise its sovereignty and maintain its support to the Ethiopian emperor and his regime. Otherwise, it could maintain the actual situation of having de-facto independence supported only by Italian recognition.

Participant	Position	Possible actions
Great Britain	Protector of hydrological interests of Egypt and Sudan.	Recognition of Ethiopian independence and sovereignty
		Maintaining the status quo that was established by a unilateral declaration that included the Blue Nile and the Sobat rivers in the British sphere of influence.
Ethiopia	A national regime controlling an internally divided country recently restored to its independence and sovereignty.	Recognition of the British interests in the Blue Nile and the Sobat rivers.
		Maintaining the status quo of de facto independence being recognised by Italy

Table 6-7: Structure of action situation of 1902.

The possible outcomes of the game show the possibility of one cooperative outcome. The cooperative outcome would be mutual recognition between Great Britain and Ethiopia over their respective interests. The second possible outcome is the case of no action which would maintain the status quo for both participants in this situation. The two other options would entail one participant recognising the interests of the other participant while other does not react positively by mutually recognising his interests. Mapping the strategies of participants and the payoff of each outcome requires the identification the valuations of the payoff of each outcome by both players.

Obviously, the historical context reveals the preferences of the British government. The prior support of the British government to the Ethiopian emperor

revealed that the British sought to change the status quo ($V_{GB\text{-}sq}$) to obtain Ethiopian recognition ($V_{GB\text{-}ETH}$). Moreover, although a quick look on the game may suggest that the valuation of Great Britain of the option of obtaining an Ethiopian recognition of its hydrological interests without any commitment ($V_{GB\text{-}ETH}$) would be higher than the case of reaching a mutual recognition ($V_{GB\text{-}mr}$), digging deeper will reveal the contrary. The British government appreciated from its previous agreement with Italy the importance of supporting the other contracting party. The defeat of the Italians was the main reason for the need to reach a new agreement over the Blue Nile and the Sobat River. Therefore, it was also in the interest of Britain to support its future ally in order to guarantee that the agreement would last for a long period. Thus, the British supported King Menelik II from 1897, not only to convince him to sign the agreement over the Blue Nile but also to assure a strong allied regime capable of controlling Ethiopia for a long time. Therefore, it would be rational for Great Britain to prefer the mutual recognition ($V_{GB\text{-}mr}$) over free riding on a unilateral Ethiopian recognition of the British hydrological interests ($V_{GB\text{-}ETH}$). Nevertheless, it would have been an unjustified loss for the British government to change the status quo ($V_{GB\text{-}sq}$) by recognising the Ethiopian interests without having a similar recognition of its own interests ($V_{GB\text{-}GB}$). This can be represented formally as follows:

$$V_{GB\text{-}mr} > V_{GB\text{-}ETH} > V_{GB\text{-}sq} > V_{GB\text{-}GB} \qquad (6.13)$$

The valuations of the Ethiopian government followed a similar pattern to the British in the strategic game. Although it may appear that Ethiopia would value the payoff that would provide it with British recognition of its own sovereignty ($V_{ETH\text{-}GB}$) more highly than obtaining recognition on a mutual basis ($V_{ETH\text{-}mr}$), the action with the highest payoff was mutual recognition ($V_{ETH\text{-}mr}$). The Ethiopian king knew that free riding over a British recognition would entail the cutting off of British support and it might lead to British retaliation. Therefore, it is rational for the Ethiopians to value mutual recognition ($V_{ETH\text{-}mr}$) more highly than free riding on the British recognition ($V_{ETH\text{-}GB}$). Obviously, it would prefer a unilateral British recognition ($V_{ETH\text{-}mr}$) over maintaining the status quo of having de facto independence ($V_{ETH\text{-}sq}$). Nevertheless, the Ethiopian regime would prefer to maintain this status quo ($V_{ETH\text{-}sq}$) instead of formally sacrificing part of its sovereignty over the Blue Nile and the

Sobat River without receiving a formal British recognition of the sovereignty of the Ethiopian territories ($V_{ETH-ETH}$). This can be represented formally as follows:

$$V_{ETH-mr} > V_{ETH-GB} > V_{ETH-sq} > V_{ETH-ETH} \quad (6.14)$$

The game that represents this action situation is represented in Table 6-8.

		Ethiopia: Recognition	Ethiopia: Status quo
Great Britain	Recognition	V_{GB-mr}, V_{ETH-mr}	V_{GB-GB}, V_{ETH-GB}
	Status quo	$V_{GB-ETH}, V_{ETH-ETH}$	V_{GB-sq}, V_{ETH-sq}

Table 6-8: Game matrix of action situation of 1902.

Depicting the preference of the players in the strategic game (Table 6-9) reveals the characteristic of the game as a coordination game. As explained above, a cooperative solution for this type of game will give both players a higher payoff than in the case of free riding on the other's action.

		Ethiopia: Recognition	Ethiopia: Status quo
Great Britain	Recognition	V_{GB-mr}, V_{ETH-mr} ★	V_{GB-GB}, V_{ETH-GB}
	Status quo	$V_{GB-ETH}, V_{ETH-ETH}$	V_{GB-sq}, V_{ETH-sq} ★

Table 6-9: Game matrix of action situation of 1902 – Possible equilibriums.

It clear that this is an assurance game where it is better for each participant to cooperate once he is assured that the other will cooperate too. Otherwise, both parties would prefer to maintain the actual situation. In other words, each actor will

recognise and guarantee the interests of the other actor once he is assured that the other actor would do the same. This is the case where we have a mutual recognition of the two parties' interests. Unless they are assured of this mutual commitment, they would prefer the status quo. This mutual commitment between Ethiopia and Great Britain was formalised by a treaty signed them in 1902.

2.1.1.3.3 Treaty of 1902

The treaty of 1902 between Ethiopia and the Great Britain relative to the frontiers between Anglo-Egyptian Sudan and Ethiopia was signed at Addis Ababa on 15 May 1902 (International Law Commission, 1974). Great Britain acted on behalf of Anglo-Egyptian Sudan, i.e. acted for itself as a co-governor of Sudan and for Egypt, the other co-governor of Sudan. Great Britain and Ethiopia signed this treaty which was intended to delimit the borders between Sudan and Ethiopia and guarantee their respective interests. Based on this treaty Ethiopia received a British recognition of its sovereignty and its borders with Anglo-Egyptian Sudan (El-Atawy, 1996). In return, limitations were established on the Ethiopian control of the Blue Nile (International Law Commission, 1974). Article 3 of this treaty stated that:

> His Majesty the Emperor Menelek II, King of Kings of Ethiopia, engages himself towards the government of His Britannic Majesty not to construct or allow to be constructed any work across the Blue Nile, Lake Tsana or the Sobat, which would arrest the flow of their waters into the Nile except in agreement with His Britannic Majesty's government and the government of Sudan. (International Law Commission, 1974)

Like the agreement of 1891 between Italy and Ethiopia, there were differences between the English and Amharic versions that created contention between the basin countries. One of these differences was that the word "any" in the article quoted above was omitted from the Amharic version. However, Britain committed itself in the negotiations to exempt the local irrigation uses from the agreement. In other words, Great Britain adopted a position that defended the prohibition of nearly any level of interference that might affect the hydraulic

integrity of the Nile Basin, except for local irrigation (Woldetsadik, 2013). Although there were differences between the English and the Amharic texts, this accord remained technically a binding legal instrument in international legal relations (Woldetsadik, 2013).

2.1.2 Egypt, Sudan and Uganda

2.1.2.1 Setting

The Egyptian Nile receives waters from East Africa streaming mainly from the White Nile sub-basin. The main strategic interactions over the White Nile included Egypt, Sudan and East Africa. Uganda was chosen to represent the African countries in this study as it was the East African country most interested in the Nile water.

The hydrological relations between Egypt, Sudan and Uganda represent the second action arena of our analysis. However, since the White Nile sub-basin was also an arena for western competition; this action arena included two additional non-basin actors: Great Britain and France. Two other colonial powers attempted to intervene in the East African regions, namely Germany and Belgium. However, Great Britain succeeded in excluding them peacefully very early from the areas that threatened its interests.

During this phase, one action situation took place that led to an agreement regulating the waters that Egypt receives from White Nile. However, this action situation can be divided into two sub-situations. The first was carried out by Great Britain, acting for East Africa and Egypt, concerning Egypt's senior rights in the White Nile. The second was between Great Britain, acting for Sudan and Uganda, regarding water rights allocation between the two countries. Since Egypt during this period achieved only nominal independence in 1922, these two games can be considered as between the British administration in Cairo and its counterpart in Sudan and East Africa.

2.1.2.2 Actors

2.1.2.2.1 France

The French interests in the Nile Basin were related not only to its historical relations with Egypt but it was also closely connected with its interest in the whole

region of East Africa. The modern relations between France and Egypt started with the brief Napoleonic invasion of Egypt at the end of the eighteenth century that lasted for only three years (1798–1801). Franco-Egyptian relations continued after the French withdrawal from Egypt, especially in the military field. The Egyptian army during this period received technical support from the French in terms of equipment and French experts (Degefu, 2003). Another field of cooperation was in education, where France was the prime destination for Egyptian scholars. Therefore, France continued to consider Egypt as within its historical sphere of Influence even after the British occupation of Egypt in 1882 (El-Atawy, 1996). France also had other interests in the Nile Basin. The French empire planned to establish and control a railway running from Djibouti to Addis Ababa. The French wanted to control the way west to the Nile and had hopes of encroaching into the British dominated trade south-west of the Nile (Waterbury, 2002).

Therefore, French strategists developed a strategy, named the "Egyptian question", at the end of the nineteenth century based on the idea that Britain could be driven out of Egypt if another colonial power controlled the sources of the Nile (El-Atawy, 1996). This strategy was expressed by the French hydrologist Victor Prompt, who had worked as the administrator of the Egyptian railway (Tvedt, 2004). He emphasised in a lecture in 1893 that any power dominating the area of Fashoda, where the White Nile and the Sobat meet, could control or even block the Egyptian Nile water, thus dominating the destiny of Egypt (El-Atawy, 1996).

Although the main objective of Prompt's proposal was to convince the Egyptian elite of the importance of immediate reoccupation of Sudan and consequent occupation of the whole Nile Basin, France was the country which interpreted his message into actions (Tvedt, 2004). France sent its first expedition to Fashoda in 1893 to put pressure on Great Britain to end its occupation of Egypt (El-Atawy, 1996). However, this expedition failed because of the lack of support of Congo and Ethiopia as well as political instability in France (El-Atawy, 1996). However, the French government decided to continue the confrontation with Britain over the Nile Basin. It suspended negotiations with Britain about spheres of influence in 1894 (Tvedt, 2004). Moreover, after the defeat of Italy by the Ethiopians

in 1896, France sent two other expeditions to Fashoda, one through Ethiopia and the other through the Congo (El-Atawy, 1996). The one that went through the Congo reached Fashoda and gained the recognition of the local rulers for establishing a French protectorate in the region (El-Atawy, 1996).

The British reaction to the presence of France was firm because of France's prior declaration of its intent against the Egyptian hydrological interests (El-Atawy, 1996). Britain attempted first to send a limited military column, known as the flying column, to expel France from Fashoda (El-Atawy, 1996). However, the failure of this limited operation induced the British to decide to occupy Sudan as a whole to end the vacuum which the Mahdist regime failed to fill after the Egyptian withdrawal from Sudan. The British were able to drive the French out of Fashoda in 1898 and then force France to drop its claims on the Nile as part of the agreement of the *Entente Cordiale* in 1906 (El-Atawy, 1996).

2.1.2.2.2 Great Britain

In the late 1880s, Great Britain had formulated a new strategy based on the unity of the Nile Basin to serve its objectives in Egypt and the British textile industry. This strategy was not limited to its declaration of the basin as its exclusive sphere of influence but it included also Sudan and Uganda (Tvedt, 2004). The establishment of the British Empire in East Africa led to the formation of a multi-nuclei British administration in the Nile Basin. However, Egypt maintained its central position in this empire and received special treatment from the British government.

The sources of the White Nile in Uganda were the first territories to be controlled by Great Britain. Uganda was the most crucial territory in East Africa for the White Nile flow as it has mouth of Lake Victoria from which the White Nile starts its flow to Egypt through Sudan. Therefore, British attempts to dominate Uganda started in 1880s even before the declaration of the Nile Basin as a British sphere of influence. In the late 1880s, the British government chartered the British Imperial East Africa Company to occupy Uganda and to govern it on behalf the government of Great Britain (Tvedt, 2004). Since German explorers were already controlling some

Ugandan territories, Great Britain prepared for its occupation of Uganda by signing an agreement with Germany in 1890 by which Germany recognised the Ugandan territories as a British sphere of influence in return for the British sacrifice of the island of Helgoland in the North Sea (Tvedt, 2004). Consequently, Great Britain established direct control over Uganda in 1893 supported by British local interest groups who believed that securing the White Nile sources in Uganda was of paramount importance for Egypt and the British interests (Tvedt, 2004). It followed its control by an agreement in 1906 with the king of Belgium, which controlled the Congo, the country adjacent to Uganda, in which the British government recognised the Belgian control of the Congo while he recognised the British sphere influence over the Nile Basin (Tvedt, 2004).

The British occupation of Sudan was motivated mainly by the British interests in the White Nile sources. Until the end of the nineteenth century, Sudan did not pose any threat to the hydrological interests of Egypt (El-Atawy, 1996). Although Sudan was under the rule of the Mahdi, who was in general hostile to Egyptian interests, it did not have the technological means to influence the flow of the Nile water (El-Atawy, 1996). However, by the end of the century, Great Britain had decided to occupy Sudan to block what it considered attempts by other western colonial powers to control territories adjacent to the Nile sources (El-Atawy, 1996). The British internal opposition induced the British government to convince the Egyptian government to pay for the costs of the military campaign to occupy Sudan by labelling the occupation as a legitimate Egyptian reoccupation of its Sudanese territories (Tvedt, 2004). The invasion of Sudan was officially carried out by Britain to protect its interests in Egypt. The growing threats from the other European powers induced the British government to get the approval of the Egyptian government for a joint military campaign to conquer Sudan (El-Atawy, 1996). Not only did Egypt assume two-thirds of the costs of the military campaign, but also Egyptian soldiers were the main fighting force in Sudan (Tvedt, 2004). Upon the invasion of Sudan, Great Britain and Egypt agreed to govern Sudanese territories jointly (El-Atawy, 1996). This agreement was described as a polite fiction for British control, Egyptian control of Sudan was only nominal (Tvedt, 2004). The British

administration in Sudan was independent from the Egyptian government and even from the British High Commissioner in Egypt (El-Atawy, 1996).

The British Empire had multiple nuclei in the Nile Basin since the administration of British colonies and protectorates was divided into separate autonomous units (El-Atawy, 1996). The local British administrations and consultants worked to serve the interests of their respective colonies (El-Atawy, 1996). Therefore, Britain did not have a unified policy towards the Nile water during the first half of the twentieth century. Each British administration in the various colonies within the Nile Basin formulated its objectives according to the economic interests of its colony. Clearly, the majority of the income would accrue to the British side, but there was internal conflict over the distribution of the revenue among the British parties. Moreover, there were tensions between the national elites of these colonies, especially Egypt, and the British administrations in their colonised countries. Therefore, the British strategy attempted to balance between the divergent interests of its colonies in the Nile Basin. However, Egypt remained the central colony in the Basin because of its economic and geo-political importance.

The British strategic movements concerning the Nile aimed to serve its own interests on the Nile and to maintain its presence in Egypt (El-Atawy, 1996). The British administration in Cairo considered the legal and technical regulation of the Nile as a major goal that would maintain political stability among Egyptian peasants and bring wealth to both the Egyptian landowners who benefited from cotton cultivation and the British elite who controlled the British textile industry (Tvedt, 2004). The growing resistance to the British in Egypt led to the concession of partial independence in 1922, reserving Great Britain's authority in four domains: the defence of Egyptian territories; the Suez Canal administration; the protection of the interests of foreign citizens in Egypt; and Sudan (El-Atawy, 1996). This partial independence weakened the control of Great Britain over Egypt. Moreover, the growing resistance to even the diminished British control over Egypt threatened the future British presence in Egypt. Thus, maintenance of its control over Egypt became an additional goal of Great Britain in the Nile Basin. Therefore, although Great Britain opted for a new Nile water allocation that would give greater shares of water

to the other colonies, the paramount importance of Egypt gave it supremacy over the other colonies.

2.1.2.2.3 Egypt

Egyptian foreign policy during this phase witnessed three main developments. Firstly, the partial independence of Egypt gave it a greater margin of freedom in forming its policies. Secondly, the growing importance of Sudanese agricultural sector to the British government represented a great challenge for the Egyptian government. Finally, the growth of the Egyptian agricultural sector challenged the ability of the Egyptian government to provide the sector with its necessary water.

Egypt maintained its traditional central administration although it had British counsellors and advisers. This hybrid structure of the Egyptian administration granted it a margin of autonomy. However, the partial independence of Egypt in 1922 granted the Egyptian government an unprecedented degree of freedom in the planning and management of various areas, including irrigation and water resources (El-Atawy, 1996). Therefore, the new pattern of relations between the Egyptian and British governments was reflected in the negotiations over the Nile water where the interests of the two sides witnessed a certain degree of divergence for the first time since the British occupation of Egypt. One of the main differences between Egypt and Great Britain was the water requirement of the newly developed Sudanese agricultural projects.

Egyptian foreign policy in the Nile Basin was shaped by its interests in the Nile water but it was also influenced by its historical relations with Sudan (Hassan & Al Rasheedy, 2011). One of the main pillars of the Egyptian policy during this period was maintaining the unity of Egypt and Sudan (Tvedt, 2004). Therefore, the Egyptian government aimed at maintaining the cordial bilateral relation between Egypt and Sudan in the light of the historical bond between the two nations (Hassan & Al Rasheedy, 2011). Thus, the Egyptian government attempted to balance between

Egypt's hydrological interests in the Nile water and the water needs of the growing agricultural sector in Sudan.

Therefore, Egyptian interests in the Nile remained the same, with the priority given to securing its senior water rights in the Nile to meet its needs. The main objective of Egypt was to maintain the status quo of the Nile water distribution (El-Atawy, 1996). However, the Egyptian government was keen to avoid the escalation of the difference in the allocation of Nile water to a clear confrontation with Sudanese administration which might have negative consequences for relations between the two nations. Moreover, a parallel objective of the water policy of Egypt during this period was to control the Nile water technically to increase Egypt's benefits from it. In spite of the continuous improvement in the irrigation system, water scarcity represented a growing pressure on the Egyptian government and its British advisors (Tvedt, 2004). This objective started to materialise during this period, as will be explained in the following section which is dedicated to the second phase of the colonial institutional change.

2.1.2.2.4 Sudan

Anglo-Egyptian Sudan was not a normal British colony. It was governed under the supervision of the Foreign Office, not the Colonial Office like the other British colonies. This gave the British administration in Sudan a relatively high degree of autonomy of action (Tvedt, 2004). Moreover, the British administration in Sudan planned for a great agricultural scheme to achieve greater financial and political independence from the British administrations in Cairo and Landon. The project expanded during the first quarter of the twentieth century. Although the project became gradually a major source of contention between Great Britain and Egypt, the historical relations between the Egyptians and Sudanese limited its negative consequence on their bilateral relations.

The plan for agricultural development in Sudan was originally introduced by the Egyptian government, but it was consequently adopted by the British administration in Sudan. In 1901, William Garstin, a Scottish engineer who was

Under-Secretary of the Ministry of Public Works in Egypt, proposed wheat cultivation on about 5 million acres of fertile land named the Gazira, "island" in Arabic, south of the confluence of the Blue Nile and the White Nile (Tvedt, 2004). The problem of the project was that the Blue Nile ran through the plains of the Gazira but at an altitude lower than that of the Gazira by 10 to 15 metres and therefore it needed an investment in irrigation works to lift the water up in a canal to the plateau of the Gazira (Tvedt, 2004). This first proposal suggested cultivating the Gazira mainly with wheat, with a small part dedicated to cotton, relying mainly on the water during the flood period to avoid any negative effect on the Egyptian share of the Nile water (Tvedt, 2004). However, the subsequent plans focused mainly on cultivating these vast plains with cotton, which meant that the Gazira scheme may compete with Egyptian cultivation (Tvedt, 2004). Therefore, this project represented the first challenge to Egypt's historical water usage as it represented a diversion in the hydrological interests of Egypt and Britain in favour of an alliance of British and Sudanese interests in the Nile water. The British administration in Sudan considered this project as a financial resource that could permit it to enjoy economic as well as political autonomy from the British administration in Egypt (El-Atawy, 1996).

Moreover, the British government found in this project an alternative that may alleviate its dependency on Egyptian cotton (El-Atawy, 1996). Predictably, both the Egyptian government and the British administration in Cairo considered the project a threat to the Egyptian water resources and agriculture sector (El-Atawy, 1996). The British government put pressure on the Egyptian regime during the first decade of the twentieth century to approve the project (Tvedt, 2004). Subsequently, the British government decided to invest in the project, granting up to 2 million pounds sterling to cultivate 120,000 acres as a first phase of the project (Tvedt, 2004). Work on the project started in 1913, but the outbreak of World War I put it to an immediate halt (Tvedt, 2004). Another project that was stopped by the war was a dam, named the Makwar or Sennar Dam, aimed at deducting 20% of the traditional Egyptian share of water to provide the Gazira plains with irrigation water (Tvedt, 2004). At the end of World War I, these projects were revived, not only for economic purposes but also with a political objective – to put pressure on the

Egyptian Nationalist elites who were calling for independence (Tvedt, 2004). In 1919, the British government decided, with the approval of the Egyptian government, to resume work in the project and to increase the area of the first phase to 300,000 acres (Tvedt, 2004). However, upon the assassination of Leo Stack, Governor-General of Sudan and the British Commander in Chief of the Egyptian Army, in Cairo on 19 November 1924, the British government announced The *Nile Ultimatum*, stating that Sudan government would *increase* the targeted cultivated area of the Gazira from 300,000 acres to an unlimited area, according to future needs (Tvedt, 2004). However, this ultimatum was a matter of internal debate and criticism in Britain as it was considered a step that could create anti-British sentiment among Egyptian peasants (Tvedt, 2004). Moreover, the Egyptian government rejected the ultimatum and froze communication with the British government over the Nile water.

Britain attempted to reflect its conflict with Egypt in the bilateral relations between the Egyptian and Sudanese people. Its objective was to create a water conflict between Egypt and Sudan that could benefit both the British water interests and strengthen the British presence in Egypt. It attempted to develop anti-Egypt sentiment in Sudan through exploiting memories of the Egyptian misrule during the nineteenth century, suppressing all pro-Egyptian political movements and establishing a new local elite that was more loyal to Great Britain than to Egypt (Tvedt, 2004). However, the informal institutions existing between the Egyptians and Sudanese, as "brothers", operated against this strategy, as Tvedt stated:

> From many points of view the British position in Sudan looked very weak. The Northern Sudanese and the Egyptians shared the same language and the same religion, and the great majority living north of the confluence of the Blue Nile and White Nile considered themselves Arab. (Tvedt, 2004, p. 101).

Therefore, Great Britain failed to develop the difference in the hydrological interests of Egypt and Sudan that would lead to conflict between the two nations. It became very clear that neither of them would attempt to escalate the situation. The British government realised that unless it convinced the Egyptian government to

resume the negotiations, the planned agricultural development in Sudan would stagnate. This forced the British administration in Sudan to approach the Egyptian government for negotiating an agreement on Nile water allocation that would preserve the Egyptian interests while taking into consideration the needs of Sudanese agriculture sector.

2.1.2.2.5 Uganda

The British administration in Uganda faced the challenge of developing Uganda's primitive economy in order to maintain its autonomy of governance over the colony. Its limited success in developing agriculture led the administration to focus on transforming the Ugandan economy into an industrialised economy. To achieve this goal, two types of resources were needed: electric power and finance.

The Ugandan economy relied mainly on the export of ivory, but this trade was negatively affected by World War I. In need of an alternative source of income, Ugandan farmers attempted to cultivate cotton and similar cash crops, without success. However, they were successful in growing coffee (El-Atawy, 1996). The main advantage of Uganda was that its agriculture sector was rain-fed. It never relied on the Nile for irrigation as it experienced a high rate of rainfall over most of its territories (El-Atawy, 1996). However, the main problem was the limited area of cultivated land relative to the population. Uganda had a cultivated area of 0.8 acres per person, which was a relatively low, rate compared with the other East African territories (El-Atawy, 1996).

Therefore, industrialisation became the main avenue for the Ugandan economy to grow and provide employment for its population (El-Atawy, 1996). This raised the need to power the industrialisation project that the British administration in Uganda planned (El-Atawy, 1996). In 1908, the well-known British politician Winston Churchill, who had fought among the Anglo-Egyptian forces in Sudan and become Under-Secretary of State for the Colonies, proposed two projects for strengthening British control in East Africa through transport infrastructure and hydro-electric power generation. Churchill's first proposal was to extend the Uganda

railway, which had been established in 1901 to link Uganda to the Kenyan port of Mombasa, from its terminus at Lake Victoria in the southeast of Uganda to Lake Albert in the northwest of Uganda to transport the raw materials needed by British industries to Anglo-Egyptian Sudan and thence by sea to Great Britain (Churchill, 1909). The second proposal was to establish the first hydroelectric power plant in Uganda, in Jinja near what was considered the source of the Nile, to provide the electricity needed for processing agricultural products in Uganda (Churchill, 1909). Therefore, the major interest in the Nile for the British administration in Uganda related to hydroelectric power while it had a little interest in the Nile water for irrigation (El-Atawy, 1996).

2.1.2.3 Action Situation: Egypt and Sudan 1929

2.1.2.3.1 Setting

The growing agricultural sectors in Egypt and Sudan were the main drivers of the negotiations that led to the agreement of 1929. By the end of World War I, it became evident that the future irrigation and agricultural plans in both Egypt and Sudan would not be possible without a formal agreement that would regulate the water allocation among them (Lumumba, 2011). However, it took the beneficiary parties more than ten years to start the negotiations of this agreement. First, a technical commission was formed in 1920 to discuss the water allocation and the future Nile project but its conclusions were rejected. In 1925, another commission was formed that led to the negotiation of the agreement.

In 1920, the Nile Projects Commission was formed from nationals of Great Britain, the United States of America and India to allocate water between Egypt and Sudan (Lumumba, 2011). In 1920, the members of the commission accepted that the historic rights of Egypt should be defined as the amount of *feddans* under cultivation, assessed at 5.4 million *feddans* in Egypt and 400,000 in Sudan (300,000 for Gezira and 100,000 for pump schemes) (Collins, 1990). The commission estimated that an allocation of 40 billion cubic metres of water for Egypt and 1.5 billion for Sudan would be enough to irrigate this area of cultivated land (Collins, 1990). However, the

members disagreed on the average annual flow of the Nile and how the extra amount could be allocated between Egypt and Sudan (Collins, 1990). One member of the commission estimated the average annual flow at 84 billion cubic metres, claiming that the extra flow should be divided between Egypt and Sudan equally (Collins, 1990). In this way Sudan would receive 22.75 billion cubic metres (1.5 billion plus half of the extra water) while Egypt would receive 61.25 billion cubic metres (40 plus half of the extra) (Collins, 1990). However, the commission was accused of fraud and of having secret connections with the British Government, especially with the British Governor of Sudan (Tvedt, 2004). Moreover, the conclusions of this commission were rejected by the Egyptian regime and elite because of their belief in the unity of Egypt and Sudan (Collins, 1990).

Two years later, Great Britain lost part of its control over Egypt with the granting of partial independence in 1922 (Tvedt, 2004). The British government attempted to use its financial and technical capacity to develop the agricultural production in a way that could threaten not only the traditional water share of Egypt but also its outstanding cotton production in the international markets (Tvedt, 2004). The success of the early stages of the Gezira scheme made it very important for financing the budget of the British administration in Sudan (Tvedt, 2004). However, the British government realised that it would not succeed in reaching any comprehensive treaty unless it controlled the damage caused by the *Nile Ultimatum* (Tvedt, 2004). Moreover, as indicated above, Britain had a very complicated imperial network in the Nile Basin: a High Commissioner in Egypt reporting to the Foreign Office; a Governor-General in Sudan also reporting to the Foreign Office; and a Governor in Uganda reporting to the Colonial Office (Tvedt, 2004). Therefore, it was normal that the Foreign Office expressed its concerns internally over the impact of the Gezira scheme on Egyptian interests (Collins, 1990). This paved the way to the negotiations of the treaty of 1929.

2.1.2.3.2 Formal analysis

Although Great Britain and Egypt faced a conflict of positions, they had common preferences regarding the future of the Nile. The two countries had a

conflict over the ownership over the Nile, however, their common interest in maximising the utilisation of the Nile made most of their strategic objectives very similar during this period. Therefore, they had to reach a compromise on their differences to achieve their common objectives.

Both participants in this game competed over the same position. On one side, Great Britain had used all its diplomatic and military power since the end of the nineteenth century to extend its influence over the Nile Basin. Therefore, the British government believed that it was the legal "owner" of the Nile. On the other side, Egypt had always believed that it had the historical the ownership of the Nile. Moreover, the partial independence strengthened the national sentiment of the Egyptian elite, inducing them to view the question of the Nile as an opportunity to prove their independence of British control. Therefore, Egypt perceived the Nile as an Egyptian river and Sudan as an Egyptian territory while for Great Britain both were British.

However, although Egypt and Great Britain differed over the identity of the river, they shared the strategic conception of the Nile River. Both countries shared the interest of establishing water storage projects to improve the efficiency of the use of the river water. Moreover, Egypt and Great Britain were keen to consider the interests of Sudan, hoping that this would play in their favour in their negotiations over Sudan question. Great Britain opted for increasing the water share of Sudan for economic reasons but under the rhetoric of breaking the Egyptian monopolistic attitude towards the Nile water (Tvedt, 2004). Egypt, although seeking recognition of its established rights on the Nile water, was willing to permit a limited growth of Sudanese share to show its good intentions towards Sudan for historical and political reasons.

Like any strategic game, the possibility of the actions of the participants in this game would largely depend on their estimations of the actions of the other parties. The first potential action was to accept an arrangement that permitted a controlled growth in Sudanese share of the water, hoping that this would be met by formal British recognition of Egypt's established rights over the Nile water. The

second action available to Egypt was to maintain the status quo that was established by the previous British agreements on the Blue Nile and Atbara and the previous agreement over the Gezira scheme. This option would leave the established historical rights untouched but not formally confirmed. Moreover, it may hinder any future cooperation with Britain for the future development of the Nile water. It would also send a negative signal to Sudanese people concerning the intention of the Egyptians towards Sudan. Similarly, Great Britain had two options in this game. The first was to recognise Egypt's established rights over the Nile with the hope that this would be met by Egyptian approval of the growth of the water share of Sudan. The second available action would be to maintain the stagnated status quo. However, this option might have negative impacts on the future plans of the Nile. It might also have negative consequences on the future projects in Sudan. Furthermore, it would send a negative signal to the Egyptian population regarding the British intentions towards Egypt.

Participant	Position	Possible actions
Egypt	The owner of the Nile and protector of hydrological interests of Sudan	Accept an arrangement permitting a controlled growth in Sudanese share of water
		Maintain the status quo of having de facto historical rights over the Nile
Great Britain	The owner of the Nile water and protector of the hydrological interests of Egypt and Sudan	British recognition of the Egyptian established rights over the Nile water
		Maintaining the status quo that was established by the previous agreements

Table 6-10: Structure of action situation: Egypt–Sudan 1929.

This is another game with one possible cooperative outcome. The cooperative outcome would involve recognition by Great Britain of the established Egyptian rights on the Nile water and Egyptian acceptance of an arrangement that allowed for an increase in the water share of Sudan. The second possible outcome would be the case of no action that would maintain the status quo for both participants in this situation. The two other options would entail one participant acknowledging the other participant's interests while other does not react positively.

Evaluating the final payoff of each outcome requires identification of the valuations of the payoff of each outcome by each player. Clearly, Great Britain would prefer the option of maintaining the status quo ($V_{GB\text{-}sq}$) over recognising unilaterally the Egyptian rights ($V_{GB\text{-}GB}$). Moreover,

$$V_{GB\text{-}sq} > V_{GB\text{-}GB} \qquad (6.15)$$

The mutual commitment option would enhance political atmosphere between the British government and Egypt, which would pave the way for the future plans of Nile water storage. Therefore, it is also logical to predict that for Great Britain mutual commitment to respecting the other participant's interests ($V_{GB\text{-}mc}$) will be valued higher by the British government than cheating on a unilateral Egyptian acceptance of an increase in Sudanese share ($V_{GB\text{-}EG}$).

$$V_{GB\text{-}mc} > V_{GB\text{-}EG} \qquad (6.16)$$

A similar pattern of valuations by the Egyptian government can be deduced in this action situation. The Egyptian government would prefer the status quo ($V_{EG\text{-}sq}$) over sacrificing part of its water share without getting recognition of its historical rights on the Nile water ($V_{EG\text{-}EG}$).

$$V_{EG\text{-}sq} > V_{EG\text{-}EG} \qquad (6.17)$$

It would place higher value on the mutual commitment option ($V_{EG\text{-}mc}$) than free riding on a unilateral British recognition of the Egyptian rights as the latter option will trigger hostility that would hinder any future plans for the Nile($V_{EG\text{-}GB}$).

$$V_{EG\text{-}mc} > V_{EG\text{-}GB} \qquad (6.18)$$

The game that represents this action situation is represented in Table 6-11.

		Egypt: Acceptance	Egypt: Status quo
Great Britain	Recognition	$V_{GB\text{-}mc}, V_{EG\text{-}mc}$	$V_{GB\text{-}GB}, V_{EG\text{-}GB}$
	Status quo	$V_{GB\text{-}EG}, V_{EG\text{-}EG}$	$V_{GB\text{-}sq}, V_{EG\text{-}sq}$

Table 6-11: Game matrix of action situation: Egypt–Sudan 1929.

The depiction of the preferences of players in the strategic game reveals the characteristic of game as a coordination, or assurance, game (Table 6-12). As explained above, a cooperative solution for such type of game will give both players a higher payoff than that is the case of free riding on the other action.

		Egypt: Acceptance	Egypt: Status quo
Great Britain	Recognition	$V_{GB\text{-}mc}, V_{EG\text{-}mc}$ ★	$V_{GB\text{-}GB}, V_{EG\text{-}GB}$
	Status quo	$V_{GB\text{-}EG}, V_{EG\text{-}EG}$	$V_{GB\text{-}sq}, V_{EG\text{-}sq}$ ★

Table 6-12: Structure of action situation: Egypt–Sudan 1929 – possible equilibriums.

As a typical assurance game, each participant would cooperate once he is assured that the other will cooperate too. Otherwise, both parties would prefer to maintain the actual situation. In this case, a mutual commitment of the two parties' interests will lead to the cooperative optimal equilibrium. This mutual commitment between Egypt and Great Britain was formalised by exchanging formal notes

between the British government and the Egyptian government regarding "The Use of the Waters of the River Nile for Irrigation Purposes" in 1929, which came to be known as the treaty of 1929.

2.1.2.3.3 Treaty

The conclusion of the treaty of 1929 was accomplished through two major steps. The first was the work of the Nile Water Commission in 1925. The second was the direct negotiations that led to the exchange of notes that constituted the treaty of 1929.

To resolve the British internal conflict and reconcile the Egyptian and Sudanese water needs, a Nile Water Commission was formed in 1925 based upon a British initiative (Collins, 1990). Its mission was to propose a basis for irrigation in Sudan which took full consideration of the rights and interests of Egypt (Foreign Office, 1929). To gain Egyptian acceptance for participation in the commission, it was agreed that Sudan would abide by the 300,000 acres that was agreed in 1919 until the approval of the report of this commission (Collins, 1990). The commission had three members: an Egyptian delegate representing the Egyptian government; a British delegate representing the government of Sudan; and a Dutch national as a head of the commission, but he died during the negotiations (Tvedt, 2004). One of the achievements of the British administration in Sudan was having Sudan represented by them in this commission on an equal footing with Egypt for the first time in the talks over Nile (Tvedt, 2004). The objective of the commission was to draft a practical working agreement that respected the established rights of Egypt in the Nile water while allowing the expansion of the irrigation projects in Sudan, mainly the Gezira Scheme, in the present and the near future (Collins, 1990). The historic rights of Egypt would be recognised while the future needs of Egypt and Sudan would be accommodated (Collins, 1990).

The report of this commission proposed that Egypt should be provided sufficient water for its already cultivated 5 million acres, which amounted to 48 billion cubic metres (Foreign Office, 1929). Since the working agreements were

supposed to be reviewed regularly, the commission avoided the proportional division of Nile water between Egypt and Sudan (Collins, 1990). Instead, they resorted to fixing the dates by which the Nile flow would be dedicated to each country (Collins, 1990). They believed that such an arrangement would give them a flexibility of changing these dates in the regular review. The Nile flow during the dry season was left to Egypt, while Sudan was granted the right to take water up to a certain maximum daily rate (Foreign Office, 1929). The natural flow of the Nile would be exclusive to Egypt during the period from 19 January to 15 July every year (Foreign Office, 1929). During this period, Sudan would only withdraw water for pump schemes in addition to the existing water withdrawn for the first phases of the Gezira Scheme (Foreign Office, 1929). The final report of the commission recognised a limited right of Sudan to withdraw water from the Nile for filling the Senner reservoir during the period from mid-July to January each year according to the annual flood and the needs of established irrigation lands in Egypt (Foreign Office, 1929). It stated that Egypt should receive all the necessary assistance from the administrative authorities in Sudan in respect of schemes undertaken in Sudan (Foreign Office, 1929).

These conclusions and recommendations were not accepted or rejected by the Egyptian government. Therefore, the British government attempted at various times to start negotiations with Egypt to reach a comprehensive agreement (Tvedt, 2004). However, the internal instability and growing resistance to the British presence in Egypt prevented the Egyptian government from responding to the British overtures. Finally, it succeeded in initiating the negotiations in 1928 after a series of low floods and conflicts over water use. These negotiations led to the abovementioned exchange of notes between the British and the Egyptian governments in regard to "The Use of the Waters of the River Nile for Irrigation Purposes", which constituted the treaty of 1929. Britain signed this bilateral treaty with Egypt on behalf of its African holdings specifically in Sudan and other East African countries (McKenzie, 2012).

The Nile water agreement of 1929 (see- appendix) has two main pillars: the recognition of the established rights of Egypt and a practical working arrangement

that was supposed to regulate the Nile until replaced by subsequent agreement (Collins, 1990). In other words, the treaty reaffirmed the established historic rights of Egypt and established Sudan as a second legal user of the river (Deng, 2011). This treaty recognised Sudan as a second beneficiary of the Nile, giving the latter a legal role in Nile development. It set quotas on the amount of water Sudan could take from the Nile before it flowed into Egypt. In this regard, the treaty did not identify the water rights, instead it recognised the conclusions of the Nile Water Commission report of 1925 as an integral part of the agreement. Both governments accepted the findings of the I925 Nile Water Commission, whose report was annexed to the treaty of 1929 (Foreign Office, 1929). It was estimated by the Commission report that Egypt's share would be 48 billion cubic metres while Sudan's share would be 4 billion cubic metres. In this way, the treaty raised the share of Sudan from less than 2% of the Nile water to around 7.7% of the total utilisable flow while decreasing the share of Egypt from around 98% to 92.3%. Last but not least, the treaty required all upstream countries to cooperate with Egypt in future Nile water storage projects.

The British government hoped that this agreement would improve the political atmosphere between Great Britain and Egypt in a way that could facilitate reaching a more comprehensive agreement between the two parties (Tvedt, 2004). The treaty succeeded in integrating the principle of established rights with the format of working arrangements. In this way it was able to provide Egypt with its necessary water without depriving Sudan of its right to develop present and future irrigation projects. This treaty was considered a stepping-stone towards a more comprehensive agreement that could give Sudan a higher share in the future (Tvedt, 2004).

2.1.2.4 Action Situation: Egypt–Uganda 1929

2.1.2.4.1 Setting

Although Britain no longer enjoyed full control over Egypt, it dominated strongly upstream territories of the White Nile (Tvedt, 2004). Therefore, Britain participated in this game as a representative of Uganda and the other East African

countries while the recently quasi-independent Egypt was the other participant. Although this action situation was separate from the situation between Egypt and Sudan, its results were materialised in a set of articles included in the treaty of 1929.

2.1.2.4.2 Formal analysis

Similarly, the conflict of positions between Egypt and Great Britain did not prevent the possibility of cooperation in this action situation. After securing its rights on the Blue Nile, Egypt aimed at obtaining recognition of its established rights on the Nile water from the upstream countries of the White Nile. On the other side, the British government, represented by the British administration in Uganda in this case, was interested in gaining technical and financial support for its future hydraulic projects on the While Nile.

The alternative actions in this situation represent a typical resource provision game where each actor has the option to invest by cooperating with the other party or maintaining the status quo. For the British administration in Uganda, the first alternative was to recognise the Egyptian established rights aiming at receiving financial and technical assistance in its future project. The second option was to maintain the status quo. For the Egyptian government, the first option was to provide, or to promise to provide, the necessary technical and financial assistance to Uganda in its future hydraulic projects. The second option was the case of no action.

Participant	Position	Possible actions
Egypt	The owner of the Nile	Pledge to finance hydraulic projects in upstream counties.
		Maintain the status quo
Great Britain	The owner of the Nile water and protector of the hydrological interests of Uganda	Recognition of Egypt's established rights over Nile.
		Maintain the status quo

Table 6-13: Structure of action situation: Egypt–Uganda 1929.

This was a pure assurance game with one possible cooperative outcome. The cooperative outcome would involve recognition by Great Britain of the established Egyptian rights on the Nile water and an Egyptian pledge of financial and technical support to the Ugandan hydraulic projects. The second possible outcome would be the case of no action that would maintain the status quo for both participants in this situation. The two other options would entail one participant fulfilling the other participant's demands while other free rides.

The valuations of the payoff of each outcome by each player can be deduced easily as this is a case of no conflict in interests at least at the time of this action situation. Clearly, the British administration in Uganda would prefer the option of maintaining the status quo ($V_{GB\text{-}sq}$) over unilaterally recognition of Egyptian rights ($V_{GB\text{-}GB}$). Moreover,

$$V_{GB\text{-}sq} > V_{GB\text{-}GB} \qquad (6.19)$$

Clearly, Egypt was in a stronger position with regard to the free-riding problem as it could negate its pledge or stop its support if the other party did not respect the agreement. Therefore, it can be deduced that the mutual commitment of fulfilling each other's demands ($V_{GB\text{-}mc}$) will be valued higher by the British government than cheating on a unilateral Egyptian pledge ($V_{GB\text{-}EG}$).

$$V_{GB\text{-}mc} > V_{GB\text{-}EG} \quad (6.20)$$

A similar pattern of valuations by the Egyptian government can be deduced in this action situation. The Egyptian government would prefer the status quo ($V_{EG\text{-}sq}$) over providing technical and financial assistance without any return ($V_{EG\text{-}EG}$).

$$V_{EG\text{-}sq} > V_{EG\text{-}EG} \quad (6.21)$$

It would place higher value on the mutual commitment option ($V_{EG\text{-}mc}$) than free riding on a unilateral British recognition of the Egyptian rights as the latter option will trigger hostility that could induce the other participant to negate its recognition of the Egyptian rights ($V_{EG\text{-}GB}$).

$$V_{EG\text{-}mc} > V_{EG\text{-}GB} \quad (6.22)$$

This assurance game has a similar representation to the previous action situation and is represented in Table 6-14 as the following:

		Egypt	
		support	Status quo
Great Britain	Recognition	$V_{GB\text{-}mc}$, $V_{EG\text{-}mc}$	$V_{GB\text{-}GB}$, $V_{EG\text{-}GB}$
	Status quo	$V_{GB\text{-}EG}$, $V_{EG\text{-}EG}$	$V_{GB\text{-}sq}$, $V_{EG\text{-}sq}$

Table 6-14: Game matrix of action situation: Egypt–Uganda 1929.

The depiction of the preference reveals that the cooperative solution for this type of game would give both players a higher payoff than the case of free riding on the other's action.

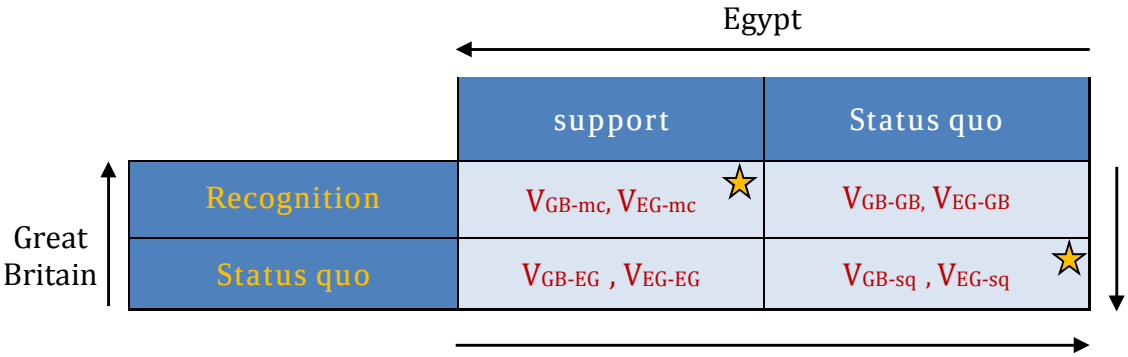


Table 6-15: Game matrix of action situation: Egypt–Uganda 1929 – Possible equilibriums.

The mutual commitment of cooperation between Egypt and Great Britain was formalised in the treaty of 1929 and its following communications.

2.1.2.4.3 Treaty

The treaty of 1929 materialised the mutual commitment of cooperation between the Egyptian government and the British administration in Uganda (see appendix). It recognised Egypt's established rights in the Nile water but also referred to the upstream projects that would be carried out by Egypt and upstream countries. Moreover, the treaty was followed by internal communications between the Foreign Office, which was in charge of British relations with Egypt, and the Colonial Office, which was governing Uganda. These emphasised that the arrangements included in the treaty were working arrangements that would be subject to regular review.

The treaty of 1929 gave Egypt veto rights on any upstream project that it believed would alter the flow of the Nile (McKenzie, 2012). Article 4 of the treaty provided that

> no irrigation or power works or measures are to be constructed or taken on the River Nile and its branches, or on the lakes from which it flows, so far as all these are in Sudan or in countries under British administration, which would, in such a manner as to entail any prejudice to the interests of Egypt, either reduce the quantity of water

> arriving in Egypt or modify the date of its arrival or, lower its level. (Foreign Office, 1929).

Moreover, the treaty gave Egypt the advantage of cooperation with upstream countries in construction of Nile-controlling structures beyond its territories (Deng, 2011). The report of the Nile Commission of 1925 included water storage and hydropower stations that would be implemented by Egypt in Uganda and other upstream countries that would benefit these upstream countries.

However, the British administration in Uganda and the Colonial Office in London expressed concern over the deprivation of Uganda of any right to exploit the Nile water for irrigation purposes (Tvedt, 2004). Similar reaction were expressed by the British administrations of Kenya and Tanganyika (Tvedt, 2004). The Foreign Office offered the Colonial Office a verbal assurance that the agreement would be binding only until the completion of the Nile projects aiming to increase the utilisable water of the Nile mentioned in the report of the commission (Tvedt, 2004). The British administration of Uganda hoped that this agreement would be a transitory step aimed at implementing the Nile projects mentioned in the report of the Nile Commission of 1925 (Tvedt, 2004). Therefore, "They grudgingly accepted the limitations put on their development in the short run, since they thought the Agreement would be renegotiated rather soon" (Tvedt, 2004, p. 147).

3 Institutional Structure of the Nile Basin – 1929

With the conclusion of the treaty of 1929, the Nile Basin had the first comprehensive formal institutional structure in its history. Instead of being governed by the historical informal institutions, the Nile had by 1929 a set of formal institutions that governed the relations among riparian countries. However, the impact of these formal rules on the historical informal institutions was not clear at that time.

The main formal institutions that were integrated in the Nile Basin institutional structure were the treaties of 1891, 1902 and 1929. These treaties regulated mainly the appropriation rights of the riparian countries. Egypt succeeded in strengthening the informal institution of its historical rights in the Nile water with a new formal institutional structures governing the Nile Basin based on the prior appropriation doctrine. Similarly, Sudan acquired a new position as second appropriator of the Nile water. Although Uganda's appropriation rights were restricted, it was looking forward to being among the winners by receiving the necessary support to establish its future hydraulic projects.

However, the Ethiopian situation was not clear. Although there were discussions over some water storage projects that could benefit Ethiopia, these discussions were not materialised in a formal binding agreement. Moreover, the new formal institutional structure was in contradiction with the historical informal institutions of the Ethiopians of their ownership of the Blue Nile. Therefore, the interaction between the new formal institutional structure and the informal structure was one of the main determinants of the evolution of the institutional structure of the Nile Basin during the following phases.

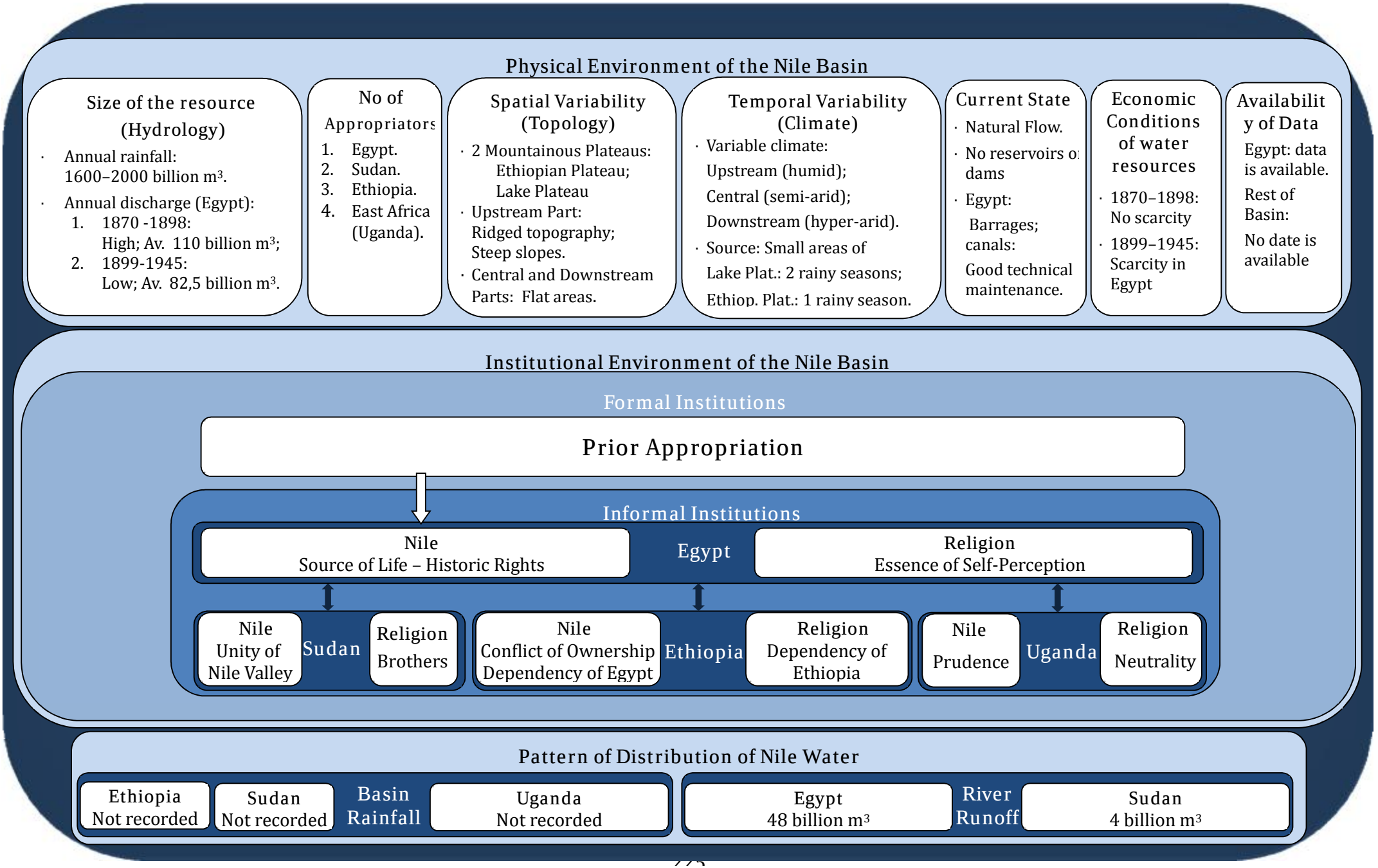


Diagram 6-7: Institutional structure of the Nile Basin in1929.

3.1 Strategic Institutional Change: Second Phase 1929–1954

3.1.1 Context: Water Storage Plans

By the end of the nineteenth century, it was very clear that Egypt needed not only to maintain its natural share of the Nile water, but also to find technical solutions to increase its water supply. The main challenge was to increase this supply during the period from January to July when the Nile flood used to recede in Egypt (Collins, 1990). There was a need to store the excess water during the period from September to November for irrigation during the scarcity period that reaches its peak during the summer season (Tvedt, 2004). By the early 1890s, control of the Nile water became the focus of the administration in Egypt. Lord Cromer, the British agent and the Consul-General in Egypt, hired a group of British engineers and water planners, who worked in cooperation with a huge staff of Egyptian irrigation officers and experts. The early proposals focused on establishing national dams within the Egyptian territories. Although some of these ideas were transformed into real projects that were carried out during the last decade of the nineteenth century and the first decade of the twentieth century, the British advisers to the Egyptian government emphasised the need for basin-wide projects to increase the water supply to Egypt.

3.1.1.1 National Projects

Several proposals were presented to construct dams within the Egyptian territories to decrease the annual fluctuations of the Nile flow. The first proposal to establish a dam at Aswan came from General F. H. Rundall, the Deputy Secretary for Irrigation to the Indian government, during a consulting tour in Egypt in 1876 (Collins, 1990). In 1891, Lord Cromer highlighted the importance of establishing a reservoir either in southern Egypt or in middle Egypt in his communications to the British government (Tvedt, 2004). He consequently instructed his British advisers and water planners to initiate a series of technical studies on potential sites for reservoirs. These studies produced a series of reports that ended with a seminal

report titled “Report on Perennial Irrigation and Flood Protection of Egypt” (Willcocks, 1894). This report was the result of a hydrological study conducted by Sir William Willcocks, the then Director-General of Reservoirs in the Egyptian government. The proposals presented in this report guided the national water projects carried out during the last decade of the nineteenth century. The report included assessment of the future annual water needs of Egypt and provided some concrete proposal for water control work as well as some ideas for future basin-wide control projects.

In this report, Willcocks began by mapping the additional water requirements of Egypt owing to the introduction of perennial irrigation and the times at which it was needed. According to his estimates, the total additional supply needed for Egypt was on average around 3.61 billion cubic metres during the period March–July of each year (Willcocks, 1894). Consequently, based on his assessment of additional annual needs of different geographical parts of Egypt, he highlighted the need to establish three reservoirs in Egypt: one of a capacity of 1.5 billion cubic metres for northern Egypt, one of a capacity of 950 million cubic metres for middle Egypt and one of a capacity of 1.16 billion cubic metres for southern Egypt (Willcocks, 1894).

To close this water gap, Willcocks presented a concrete proposal for establishing a dam in southern Egypt combined with barrages in different locations in Egypt. After a detailed study of possible sites of future reservoirs in the Nile valley, Willcocks provided five possible sites for establishing the proposed dam in South Egypt. Clearly, the size and the capacity of the proposed dam would differ according to its site. The biggest one of the five proposed dams would provide Egypt with the needed 3.6 billion cubic metres (Willcocks, 1894). The report was approved by the Technical Commission of Reservoirs appointed by the Egyptian government to examine the various projects for the storage of Nile water (Technical Commission of Reservoirs, 1894). Moreover, the commission emphasised from a geological perspective that the optimal site for the dam would be above the first cataract at Aswan. This proposed dam would be the biggest dam in the world as nothing of its scale had ever been attempted. The Aswan dam was designed to have maximum

capacity 3.6 billion cubic metres which would provide Egypt with its necessary additional water (Technical Commission of Reservoirs, 1894). The Egyptian government later reduced its planned water storage capacity to 2.5 billion cubic metres, without reducing its size, owing to technical difficulties related to flood and silt management (Tvedt, 2004). However, since the technical commission noted in its report that the proposed dam would inundate the pharaonic temple at Philae Island, public opinion in the United Kingdom and Europe put pressure on the British administration in Cairo to change its plans.[3] Finally, the capacity of the dam was reduced once more to around 1 billion cubic metres. The construction of the dam was completed in 1902 with a height of 37 metres (D. , 1913). The construction of the dam was combined with the construction of several barrages along the course of the Nile to raise the water level then divert it through canals to more remote perennially irrigated lands and to the newly irrigated land in northern parts of Egypt (Garstin, 1901).

Nevertheless, Willcocks predicted in his report, even before the reduction of the Aswan Dam's capacity, that the dam would be only a temporary solution for the water deficit in Egypt. He expected that the continuous growth of the agriculture sector would force Egypt to resort to controlling the water of the Upper Nile. Although he did not present concrete proposals for the construction of dams on the lakes of the Upper Nile, he believed that this would be the future solution of the water deficit in Egypt. He stated:

> The resources of modern science could be employed to utilise these great lakes, and, by the construction of suitable works, insure a constant and plentiful supply of water to the Nile valley during the summer months when water is scarce and as valuable as gold. Both the Victoria and the Albert lakes lend themselves to be utilised as reservoirs as they have rocky sills at their outlets, while the Albert and Tsana lakes by their convenient size are eminently suited for regulating basins. The day these works are

[3] The commission was composed of three members: Benjamin Baker (British); Auguste Boulé (French) and Giacomo Torricelli (Italian). The commission report indicated that the commission failed to reach a consensus over the problem of inundation of Philae temple. On one the hand, the majority, Baker and Boulé, decided to approve the project but with allocation of a budget to move the temples to a higher site. On the other, Torricelli rejected this idea and "refused to accept any responsibility with respect to Philae temple" (Technical Commission of Reservoirs, 1894, p. 56).

> carried out at the sources of the Nile, the lakes will take their proper place in the economy of the water supply. (Willcocks, 1894, p. 153).

Moreover, the reduction in the capacity of Aswan Dam left Egypt with a water deficit of around 2.6 billion cubic metres. This deficit stimulated water planners to reflect on the idea of establishing water control projects beyond the borders of Egypt.

3.1.1.2 Basin-wide Projects

The Egyptian government had to resort to basin-wide projects to raise its water supply to meet its agricultural needs and to be able to carry out its future plans. As indicated above, Egypt suffered at that time from a water deficit of around 2.6 billion cubic metres of water (Garstin, 1901). Moreover, it was estimated that Egypt had potential lands for agriculture that needed around 4 billion cubic metres of water (Garstin, 1901). Therefore, Egypt needed around 6–7 billion cubic metres of water to achieve its potential agricultural production.

The main proposals for the technical control of the Upper Nile water for increasing the Egyptian benefits from it were presented by the successive British advisers to the Egyptian governments. The first solid set of proposals for the Nile was produced by Sir William Garstin, the Inspector-General of Irrigation at the Egyptian Ministry of Public Works. The technical analysis and planning for the Nile water control introduced by William Garstin has dominated the Nile Basin until these present days. These proposals were introduced in two successive studies. The first study was published in 1901 under the title "Report as to Irrigation Projects on the Upper Nile" (Garstin, 1901). The second was published in 1904 and was titled "Report upon the Basin of the Upper Nile with Proposals for the Improvement of the River" (Garstin & Dupuis, 1904).

3.1.1.2.1 Garstin's Plan of 1901

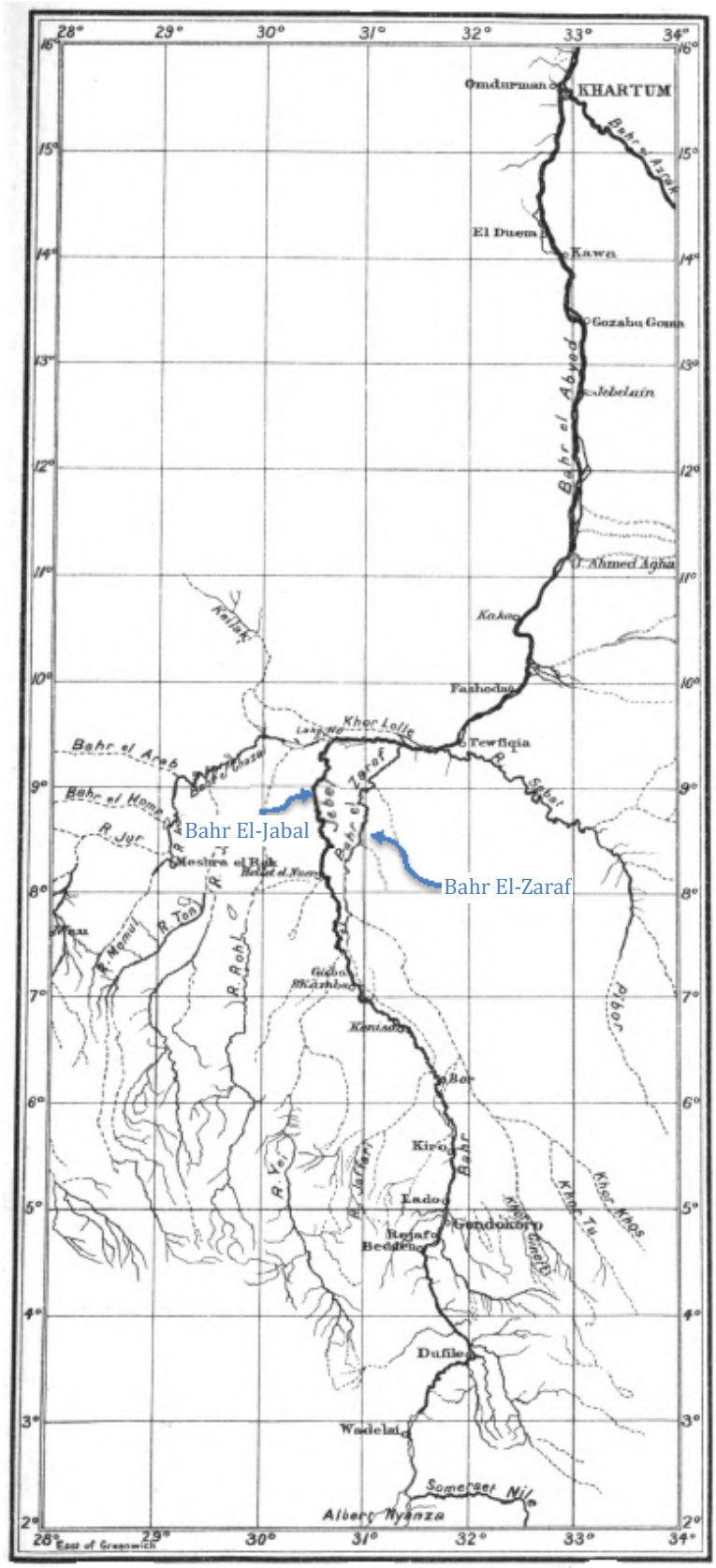
Based on his hydrological surveys of the Nile River, Garstin introduced in his first report published in 1901 a set of proposals that established the foundations for the Nile water development until the present time. His initial proposal was to

complement the Aswan Dam with another dam in northern Sudan, either in the second or the third cataracts, to store the necessary water for Egypt (Garstin, 1901). However, he noted that this dam would serve only Egypt without taking into consideration the needs of agricultural development in Sudan. Therefore, Garstin emphasised the necessity of establishing dams in the Upper Nile to overcome the water deficit in Egypt. He acknowledged that this idea was introduced and defended by Willcocks. Consequently, he presented three main proposals in this regard: the construction of a storage reservoir in Lake Albert; the embankment of Bahr Al-Jabal or the use of Bahr El-Zaraf as an additional channel to decrease the losses of the swamps in the south of Sudan; and the construction of a reservoir in Lake Tana.

Garstin chose Lake Albert to be the main reservoir of the White Nile. He first studied the possibility of establishing a dams at the exit of Lake Victoria or Lake Albert. He found that although damming the exit of Lake Victoria would provide a much bigger amount of water storage, establishing a dam at the mouth of Lake Albert would be sufficient and much more feasible. On the positive side, according to his calculations, since the area of Lake Victoria is around 70,000 square kilometres, a dam 3 metres in height would raise the water by 210 billion cubic metres which would yield 140 billion cubic metres after deducting the loss by evaporation. This amount of water is much higher than the needs of both Egypt and Sudan. On the negative side, the area surrounding Lake Victoria was characterised by a high population density. Therefore, the rise of the water level as a result of damming the mouth of the lake would result in flooding a large and populous area. On the other hand, although Lake Albert covered a relatively small area, it would provide sufficient water storage without significant harm. Since its area is around 5000 square kilometres, it would provide a storage of around 15 billion cubic metres with a 3-metre dam. This would result in 10 billion cubic metres after deducting the loss by evaporation. This would provide Egypt with the 6–7 billion cubic metres that it needed and the rest could be devoted to Sudan. Therefore, his final proposal was to establish a dam somewhere at the exit of Lake Albert.

However, he noted that this dam would benefit mainly Egypt and the northern Sudanese provinces which lie to the north of Khartoum, as the surrounding

lands in South Sudan were characterised by poor and light soil. Moreover, he acknowledged that this project would face two main challenges. First, the areas which the White Nile passes in South Sudan consist of swamps that absorb half of the annual discharge. Second, the level of the water of the White Nile is lower than its surrounding lands. Moreover, its slope is too low to provide the water with sufficient strength to flood the surrounding lands. Therefore, it would be difficult to use this water for irrigation without construction and mechanical work. Garstin offered two new solutions to overcome these two challenges.



Map 6-1: Map drawn by Garstin (1901) for Bahr Al-Jabal and Bahr El-Zaraf.

(Note: The map is edited in blue colour for clarification purposes.)

The first solution was to improve the water flow through the swamps of southern Sudan. He considered this solution necessary on its own, even without the construction of the Lake Albert dam, to reduce the water loss in the swamps. Garstin provided two options to achieve this result. The first option was the embankment of the river for its whole length between River Bor and Lake No, around 624 kilometres. This would confine the water of the flood into a single channel, preventing it from spreading over the swamps. However, he recognised the difficulty of this solution because of the climate of this region and the difficulty of finding reliable labour among the local population. The second option was the embankment of Bahr El-Zaraf to enable it to carry the summer flood water of the White Nile. He preferred this option because the work necessary for it is less difficult.

The other solution that was offered by Garstin as a complementary or alternative option to the damming of Lake Albert was the damming of Lake Tana. He suggested the construction of a dam at the exit of Lake Tana. According to his calculations and estimations, the lake has an area of around 3000 square kilometres. However, it has the advantage of being deep as it is situated on a plateau at an altitude of around 1775 metres above sea level. Therefore, the construction of a dam that would raise its level by 5 metres would result in a storage of 132 billion cubic metres. Moreover, the lake is surrounded by sparsely inhabited areas which diminished the harm of raising the level of the lake. Two other advantages were cited by Garstin in favour of damming the exit of Lake Tana. First, the water storage in Lake Tana would allow a controlled release of water into the Blue Nile. This would allow the irrigation and cultivation of the fertile lands of Sudan that were usually flooded by the water without benefiting from it because of the strength of the floods. Second, the release of water in summer, which is the usual dry season, would enable the utilisation of the Blue Nile as a stable trade route throughout the year. Therefore, Garstin pointed out that the Lake Tana reservoir would be the best option from a technical point of view.

Therefore, Garstin offered his three proposals, ordered according to their importance. First, the construction of a dam at the exit of Lake Tana to store the water needed for both Egypt and Sudan in the lake. Second, the improvement of the

water channels in South Sudan by embanking either Bahr Al-Jabal or Bahr El-Zaraf to be utilised as an extra channel of water to the White Nile. Last, the construction of a dam at the exit of Lake Albert to supply Egypt and North Sudan with their water needs.

However, although Garstin considered the Lake Tana dam the best option to supply Egypt and Sudan with sufficient water, Lord Cromer warned against even discussing such a project. He emphasised, in his introduction to the report, the existence of practical difficulties that would face the Lake Tana reservoir. Cromer was aware of the complexity of the historical relations between Egypt and Ethiopia. Therefore, he referred implicitly to what has been described in this study as a conflict of informal institutions of ownership of the Nile between Ethiopia and Egypt, supported by the Great Britain, when he stated:

> The great objection to utilising Lake Tsana consists in the fact that it lies in Abyssinian territory. I need hardly say that no project can be executed without the full consent and approbation of the Emperor Menelek. However considerable may be the material gain, there can be no question of entertaining any proposal which would be calculated to disturb the very friendly relations now subsisting between Great Britain and Egypt, on the one hand, and Abyssinia on the other hand. I may even go further and say that, in my opinion, it is essential that nothing should be done which would engender even a suspicion in the minds of the Emperor Menelek or his subjects that there is the least intention of adopting an aggressive policy towards any portion of His Majesty´s dominion. It is scarcely necessary to remark that no such intention exists. It is desirable to make these observations, as the very incorrect rumours, which are occasionally current respecting British and Egyptian intentions towards Abyssinia, may possibly gather some strength when it becomes known that a project for utilising Lake Tsana is under discussion. (Garstin, 1901, p. 5)

3.1.1.2.2 Garstin's Plan of 1904

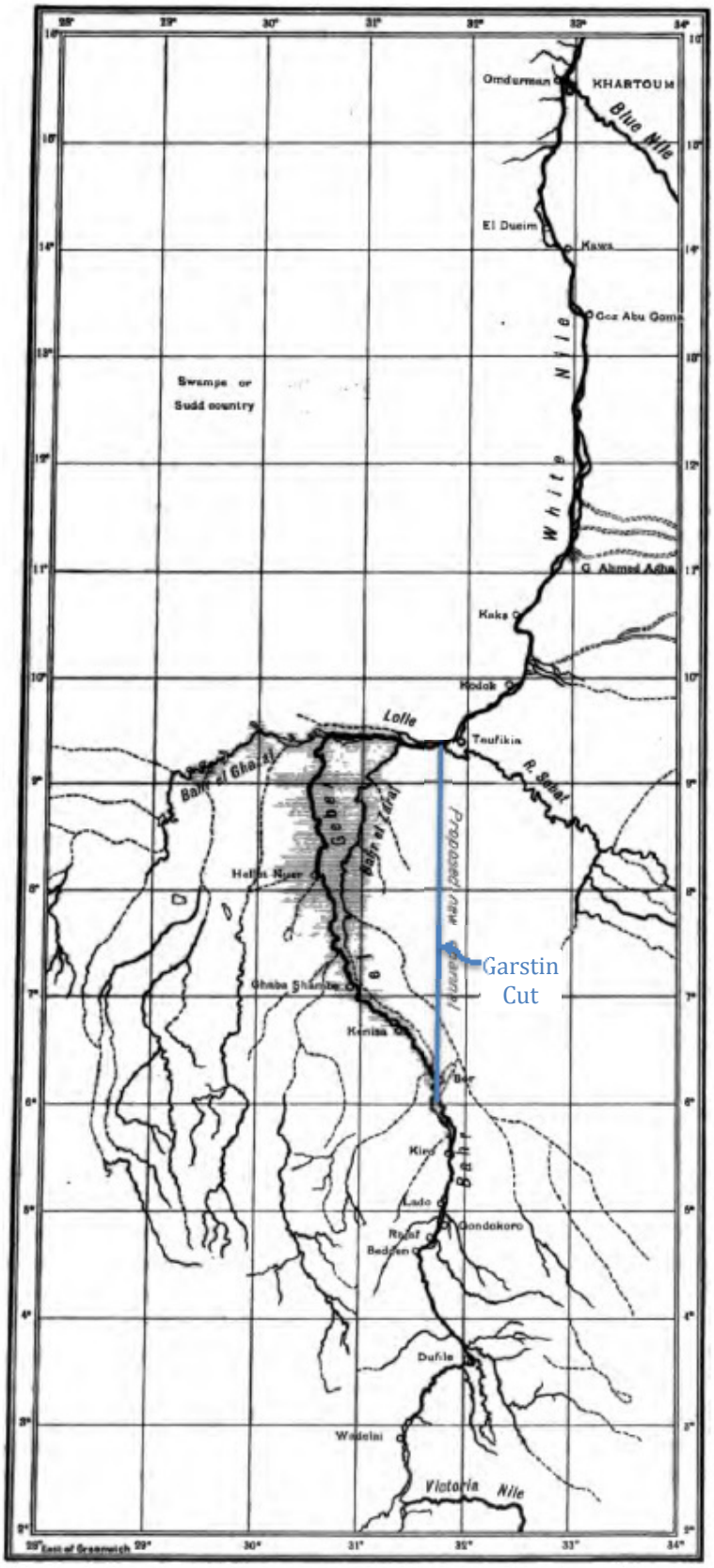
In 1904, Garstin and Dupuis, one of the hydrologists in the Egyptian Irrigation Department, published a new report that included more detailed plans for future water storage of the Nile water (Garstin & Dupuis, 1904). This report

benefited from two developments that occurred between 1901 and 1904. First, Garstin and Dupuis made prolonged tours in the Upper Nile region between 1901 and 1904 to concretise their proposals. These trips equipped them with more accurate information about the Nile's hydrological features and the needs of Egypt and Sudan. Second, J. S. Beresford, the former Inspector-General of Irrigation in India, suggested to Garstin in 1902 the construction of a direct-line canal from the mouth of the Sobat River to the Bor River in order to bypass the Sudd swamps region (Collins, 1990). This creative proposal enabled Garstin to present in his new report a technically feasible solution to the problem of water loss in the swamps in the south of Sudan (Garstin & Dupuis, 1904).

One of the salient features of this new report was the clear distinction between projects that should be dedicated to the benefit of Egypt and those that should be carried out to support the agriculture sector in Sudan. Moreover, the abovementioned developments led Garstin to reprioritise the proposals previously presented in his report of 1901. Garstin now gave the top priority to the project of the new canal between the Sobat and the Bor rivers. The construction of a dam at the outlet of Lake Albert came second on his list of future projects of water control. Finally, although he recognised the technical feasibility of damming Lake Tana and transforming it into a reservoir, he called for this project to be postponed for political reasons.

Garstin clarified at the beginning of his report that the report aimed not only to serve the water sector in Egypt but also the same sector in Sudan. He indicated that the report investigated the available options to increase the water supply of both Egypt and Sudan in the summer. Moreover, after exploring the different proposals for controlling the Nile water, he emphasised that Egypt and the lands lying north of Khartoum would get their needed summer supply from the water-control constructed on the White Nile. Therefore, he suggested dedicating the water-control projects carried out on the Blue Nile to Sudan (Garstin & Dupuis, 1904). However, he was not optimistic about the possibility of the implementation of the Blue Nile projects.

The report highlighted the importance of reducing the loss of water from the swamps in the south of Sudan. Garstin emphasised that technical solutions should be implemented to reduce this wastage even before carrying out water-control projects in the Equatorial Lakes that supply the White Nile. He clarified that any project for increasing the effective water discharges of the Equatorial Lakes would be wasted in the swamps of the Sudd region. The only solution likely to yield any additional water discharge would be to secure the passage of the water through these marshes. Moreover, Garstin dismissed his earlier proposal of embanking either Bahr Al-Jabal or Bahr El-Zaraf. He indicated that the storage of the water in either Bahr Al-Jabal or Bahr El-Zaraf until the end of the flood of the Blue Nile would result in huge floods in the swamps. These floods would cause the drifting of large areas of grasses that would block the water channels in the swamps region. Therefore, he proposed the construction of a direct channel to bypass the whole area of the swamps. This new channel, named at that time the Garstin Cut, should run from the mouth of the Bor River at the beginning of Bahr Al-Jabal to the point where the Sobat River discharges into the White Nile (Map 6-2). The length of the proposed Garstin Cut was around 360 kilometres (Garstin & Dupuis, 1904). The Garstin Cut, which later came to be known as the Jonglei Canal, was expected to carry 28 billion cubic metres per year (Collins, 1990). The water in this channel would be controlled by two regulators; one at its beginning and one at its outlet. In this way, the needed water would be stored in this channel while leaving the swamps as a drain and regulator of the extra flood water. Moreover, the passage of the water would be facilitated and distance travelled greatly reduced by running in a straight channel.



Map 6-2: A map drawn by Garstin for the new direct channel (Note: the map is edited in blue colour for clarification purposes) (Garstin & Dupuis, 1904).

Garstin renewed in his report his previous proposal of building a dam at the outlet of Lake Albert. He reaffirmed that Lake Albert constituted a more constant and stable source of water throughout the year. Moreover, a rise in the level of the water of the lake would result in relatively small evaporation losses. Therefore, he renewed his suggestion of constructing a dam for Lake Albert as well as regulating works at the outlet of Lake Victoria. He identified the best location for building the dam 15 kilometres downstream of the outlet of Lake Albert. Moreover, he endorsed an earlier suggestion by Willcocks to build the regulator of Lake Victoria at Ripon Falls. Willcocks suggested lowering the crest of these falls to avoid the negative consequences of raising the water level of Lake Victoria.

The report presented the project for the construction of a dam at the outlet of Lake Tana as a project for increasing the water supply to Sudan rather than Egypt. The proposal presented was to dam the outlet of the lake to use it as a controlled storage reservoir. Another regulating dam was proposed to be constructed inside Sudan, between Famaka and Rosaires, to regulate the flow of the water to Sudanese territories. Another barrage was proposed to be constructed at Wad Madani, south of Khartoum, to distribute water to the Gezira scheme (Garstin & Dupuis, 1904). The proposal was supported by the results of a research trip conducted by Dupuis in 1902 to the Ethiopian territories which revealed the feasibility of the project of the Lake Tana reservoir. Dupuis estimated that the effective storage capacity of the reservoir would be 3 billion cubic metres in an average rain season. He clarified that this capacity might fall to 2 billion cubic metres in scant seasons and rise to 5 billion cubic metres in abundant seasons (Garstin & Dupuis, 1904). The lowest estimation of the effective capacity of this reservoir was 2 billion cubic metres, to be utilised mainly by Sudan (Brown, 1904).

However, Garstin recognised that the political climate would hinder the project of Lake Tana, expecting that this project would not be carried out in the near future. The project was described by Garstin as “the best and most certain method of increasing the Blue Nile supply, during the months prior to the annual rise” (Garstin & Dupuis, 1904, p. 183). However, he concluded the section of his report on this project by stating that:

> There can be no two opinions as to the suitability of Lake Tsana, as a storage reservoir for the Blue Nile … Unfortunately, owing to its situation, the political difficulties appear to be so great, that the chance of any such work being carried out must be relegated to a very distant future, if not abandoned altogether. Doubtless, at some period in the world's history, these difficulties will disappear, and advantage will be taken of the obvious suitability of this lake, as a great natural reservoir. (Garstin & Dupuis, 1904, p. 186).

This conclusion was supported again by Lord Cromer in his introduction of the report, where he emphasised that: "In spite of the engineering advantages to be obtained by the adoption of the Lake Tsana project, I am of the opinion that, on political grounds, the alternative plan mentioned above is to be preferred." (Garstin & Dupuis, 1904, p. ix).

Therefore, it can be argued that both Garstin and Cromer were aware of the difficulties posed by the historical and cultural factors, i.e. informal institutions, which constrain the cooperation between Egypt and Ethiopia.

In summary, the report of Garstin and Dupuis of 1904 had two main achievements. The first was the presentation of more detailed proposals for controlling the Nile water. The second was reordering the proposed projects according to their importance and feasibility. Garstin Cut was given top priority to be implemented before, or even without, the construction of the Lake Albert reservoir. Finally, the Lake Tana project was proposed to be postponed for an indefinite period in the future. Unfortunately, the outbreak of World War II brought the whole plan to a halt.

3.1.1.2.3 Nile Control: 1920

The third important plan for water control was included in a report published in 1920. Although this plan was as not technically sound as the previous one, it has influenced Nile water planning until today. The report was prepared as a reaction to a public criticism of the projects adopted by the British and Egyptian governments for regulation of the Nile water. The projects adopted included the establishment of two dams in Sudan. The report attempted to put these two dams into a wider plan

that included the previously proposed dams on Lake Tana and Lake Albert as well as the Garstin Cut. However, it lacked the necessary technical and financial analysis of the projects included in the proposed plan. Nevertheless, the plan was formulated by the commission that was appointed by the Egyptian government, reviving in this way the old plan of Upper Nile control.

In 1912, Egypt witnessed the appointment of two new British senior officials interested in the development of the Nile water resources. The first was Lord Kitchener, who replaced Lord Cromer as the British agent and Consul-General in Egypt. The second was Murdoch MacDonald, who was appointed as adviser to the ministry. MacDonald assumed in practice the work of Garstin who left Egypt in 1908. However, neither had the experience nor the knowledge of his predecessor (Collins, 1990). MacDonald had a belief that investment in the agriculture sector in Sudan would be more beneficial to the United Kingdom. Moreover, he was convinced that Nile water could be developed to provide sufficient water for the needs of both Egypt and Sudan. Therefore, he obtained the approval of the British and the Egyptian government for the construction of two dams in Sudan. Sennar Dam was built on the Blue Nile mainly to satisfy the water needs of Sudan. The second, the dam of Jabal Awliya, was constructed on the White Nile to serve the water needs of Egypt.

However, as a result of the criticism levelled at his work, MacDonald had to prepare a new detailed water control plan in 1920. MacDonald faced severe criticism from his British and Egyptian colleagues, especially Willcocks, for his proposed dams at Sennar and Jabal Awliya. He was accused of deliberately tampering with the data to gain the approval of the Egyptian and British governments for his proposal. The criticism escalated to legal accusations of deception and corruption. In 1918, the Egyptian government, acting on advice from the British government, appointed a six-man committee to examine MacDonald's proposals and the criticisms of them. However, the conclusions of the committee were rejected by the Egyptian Nationalists and the press. In an attempt to absorb the criticism, the Egyptian government appointed a more neutral commission named the Nile Projects Commission. The commission was composed of three members: two British experts and one American engineer, with no previous connection with the British officials

working in Egypt. The commission was meant to evaluate the proposed projects and make recommendations for their implementation.

It was against this background that MacDonald wrote his report titled "Nile Control" to provide a comprehensive framework for the Nile regulation projects. Although the report was published, its main aim was to be submitted to the Nile Projects Commission. In this report, MacDonald not only attempted to justify the need for the construction of two dams in Jabal Awliya and Sennar but also revived the proposals for building dams at Lake Tana and Lake Albert as well as digging the direct canal to avoid the swamps of the south of Sudan known at that time as the Garstin Cut. He justified the need for building the Jabal Awliya dam on the White Nile on two grounds. First, he clarified that the dam would form a storage reservoir that would increase the water supply of Egypt by 4 billion cubic metres after deducting evaporation loss (MacDonald, 1920). Second, he argued that the dam would protect the surrounding areas from the danger of floods (MacDonald, 1920). He provided a detailed description of the proposed structure and the operation of the dam. With regard to the Lake Tana dam, he gave a one-page review that concluded by suggesting that dam should be built by 1930 with a capacity of 7 billion cubic metres (MacDonald, 1920). Similarly, the analysis of the Lake Albert dam was relatively brief. However, this analysis was distinctive in that it introduced the idea of over-year storage. MacDonald stated that his objective was:

> To construct a dam at Lake Albert and turn the lake into a reservoir where a store can be held in reserve from year to year without important loss and where some of the water that is now wasted in the swamps in flood may be stored until summer.. (MacDonald, 1920, p. 134)

He estimated that such a reservoir would have a capacity of around 40 billion cubic metres. He referred to the necessity of constructing the channel that would transfer water stored in Lake Albert to the White Nile but without any technical details. He suggested only a comparative study for the two alternatives suggested earlier by Garstin: the embankment of Bahr Al-Jabal or Bahr El-Zaraf; and the construction of a direct channel linking the Bor with the Sobat. Nevertheless, he expected that a

combination of the two alternatives could achieve better results. He estimated that part of the supply could be directed safely through either Bahr El-Zaraf or Bahr Al-Jabal while the rest could be sent through the proposed canal (MacDonald, 1920).

Although *Nile Control* was prepared by MacDonald as a defence against the criticism levelled against him, the plan included in this report was approved by the Nile Projects Commission. The plan that was presented in the report was incomplete and unbalanced in its treatment of projects. The dams of Jabal Awliya and Sennar received a detailed analysis while the Upper Nile projects on Lake Tana and Lake Albert were briefly reviewed. Moreover, MacDonald ignored the developing North–South divide in Sudan. After the colonisation of Sudan, Great Britain failed to use the traditional tribal organisations of the peoples of southern Sudan to establish their authority in the region as they did in Uganda. Therefore, the British government relied on troops from northern Sudan to govern the southern Sudan (Collins, 1971). However, the increasing influence of the Arab-speaking Muslims over the African traditional southerners represented a source of concern for the British colonisers (Collins, 1971). Since they had no better choice, they tolerated this influence while mobilising Christian missionaries to the South. Moreover, they segregated Muslims and non-Muslims, especially in education (Collins, 1971). This British-made friction developed over time in way that not only threatened the implementation of the Nile projects in southern Sudan but has destabilised the region until today. In sum, the report lacked the necessary depth and sophistication that was required for such a trans-border plan. "Nile Control reads as if it were prepared in haste, pieced together in a style devoid of elegance" (Collins, 1990, p. 141).

However, the Nile Project Commission approved the immediate construction of the dams at Jabal Awliya and Sennar. Moreover, it sanctioned the construction of the dams of Lake Tana and Lake Albert as well as the excavation of a Sudd canal. Although these were not perceived at the time of its presentation, MacDonald's plan had two important long-lasting implications. Firstly, it founded the principle of over-year storage that has remained the dominant perspective of Nile control planning until today. Second, it revived the project of the Lake Tana reservoir, ignoring the political difficulties, or informal constraints, perceived by Cromer and Garstin which

had led to dropping the projects from the plans for Nile control. The Nile Projects Commission's approval of this project influenced the British policy in the Nile Basin, as we shall see later. Moreover, most of the proposals of this plan formed part of the report of the Nile Projects Commission published in 1925, which became a complementary part of the Treaty of 1929. Therefore, it guided the Egyptian and British policy even after the end of the British occupation of Egypt in 1954.

To conclude, although the plan included in *Nile Control* was not as comprehensive as those elaborated by Willcocks and Garstin, it was sanctioned by the British and Egyptian governments. The immediate consequence was the construction of dams at Sennar and Jebel Awliya in Sudan. The long-enduring effects were the introduction of the over-year storage planning strategy and the endorsement of the efforts aiming at the construction of dams on Lake Tana and Equatorial Lakes as well as the Sudd canal. These efforts have continued until today with mixed results.

3.1.1.2.4 The Future Conservation of the Nile: 1946

By the end of the 1930s, three of the proposals presented in the successive plans of the regulation of Nile were carried out. First, the "Old" Aswan Dam was built and raised twice, first between 1907and 1912 then between 1929 and 1933, to its maximum height. Second, the Senner Dam on the Blue Nile was constructed in 1926 to supply the necessary water for the Gezira Cotton Scheme in Sudan (Waterbury, 1979). Last, the reservoir of Jabal Awliya was built on the White Nile in 1937 south of Khartoum to serve northern Sudan and Egypt (Waterbury, 1979). The rest of the proposals, including the Lake Albert reservoir and the Sudd canal as well as Lake Tana reservoir, were not implemented.

After the end of World War II, the Egyptian Ministry of Public Works attempted to revive the Upper Nile projects. The ministry published another updated comprehensive plan prepared by Hurst, Black and Simaika titled *The Future Conservation of the Nile*. Although the proposals included in this plan were not new, the plan had three distinctive features. Firstly, Hurst and his collaborators

refurbished the *over-year storage* introduced by MacDonald in a more solid concept defined as century storage. Secondly, they integrated the previously introduced proposals in a coherent plan, showing the interlinkages between them (Collins, 1990). Finally, they used more reliable data sets compiling the information of half a century.

The report emphasises the importance of over-year storage as a basis for the Nile control project. The main objective of such a scheme is to maintain a relatively constant yearly water supply for Egypt that can satisfy its needs. Hurst (1946) explained that can be achieved by storing enough water from the good years of flood that can compensate the shortage in low-flood years. This could be achieved by storing water equal to the average annual flow to Egypt. However, since the cycles of high and low floods are variable over short periods, Hurst (1946) argued that the longer the period over which the average is calculated, the more likely that an exceptionally low or high flood would be accommodated. Calling his concept *century storage*, he suggested that storage capacity of the water control projects should be the average annual flow for 100 years. Since the available data at that time covered only 50 years, he resorted to statistical methods to calculate the required capacity of the reservoirs.

Although the suggestion of converting Lake Albert into a large reservoir with a regulator on Lake Victoria had been introduced before by Garstin and MacDonald, Hurst was the first to provide a clear justification and explanation of the operation of such reservoir. He justified the selection of the Equatorial Lakes as the location of such a reservoir and its regulator by referring to its balanced rainfall-evaporation rate. Regarding the choice of Lake Albert as the site of the reservoir, he reiterated what Garstin and MacDonald mentioned about its limited area which would reduce the losses by evaporation. Moreover, he clarified that the geographical configuration of Lake Albert would limit the evaporation losses as a result of raising its level. With regard to the technical specifications of the proposed reservoir, he estimated that if Lake Albert was used as a reservoir without a regulator in Lake Victoria, the needed capacity of this reservoir would be 155 billion cubic metres. However, if Lake Victoria was used as a complementary regulator, the needed capacity of the

reservoir at Lake Albert would be only 100 billion cubic metres. He added that this capacity would be raised to 140 billion after the construction of the Sudd canal. He explained that a small dam at Lake Victoria that would raise the level of the lake between 1.8 and 2.8 metres would result in storage capacity of 60 billion cubic metres. Therefore, a reservoir of only 80 billion cubic metres would be needed in Lake Albert. This would entail raising the level of the lake by 25 metres with 2 or 3 metres that could be added as a precaution against wave action and errors of estimations. He estimated that building such dams and filling the reservoirs would take 20 years. However, he stressed that the full use of such a century storage reservoir would not be achieved unless the problem of water losses in the Sudd region was addressed.

Therefore, Hurst studied the successive projects of the Sudd canal and provided a modified one that could transfer the water resulting from the century storage project. The last project was presented by the Egyptian Ministry of Public Works under the name of Jonglei Canal. Hurst indicated that the capacity of the canal in this project would not be enough to carry the water of the century storage project. Therefore, he suggested another path for the canal, which is longer and wider to carry the expected flow of the Nile after the completion of the century storage project. The dimensions he proposed for the canal were a depth of 5 metres and a bed width of 120 metres. According to Hurst's plan, the century storage should send an annual flow of 24 billion cubic metres. Out of this annual flow, 8 billion cubic metres would be sent to the canal while 16 billion would flow normally through Bahr El-Jabal to the White Nile. This could add nearly 5.2 billion cubic metres to the annual flow of the Nile to Egypt in the years of average floods. He also proposed a gradual embankment of Bahr El-Jabal to increase the water flow to the White Nile.

Lake Tana reservoir was also proposed as a joint project that could provide Egypt and Sudan with water while providing Ethiopia, known as Abyssinia at that time, with hydroelectric power. The main addition of Hurst was his suggestion of building a second century storage reservoir instead of an annual reservoir that could provide Sudan and Egypt with water in the dry season. This reservoir should complement the reservoir of the Equatorial Lakes. He proposed the construction of

a large reservoir that could be used in combination with the Lake Albert Reservoir to provide a fixed annual quota to Egypt and Sudan. He estimated that a reservoir of a total capacity of 7 billion cubic metres could add around 2.1 billion cubic metres in the years of average flood. Therefore, the century storage in the Equatorial Lakes and Lake Tana could increase the Nile discharge for Egypt and Sudan by 7.3 billion cubic metres. Finally, he suggested that this project should be complemented by a reservoir on the Main Nile on the Northern Sudan, between Atbara and Wadi Halfa, to be used for flood protection and for summer storage. He estimated that this reservoir would add another 3 billion cubic metres to the Main Nile discharge. He expected that these projects would need around 25 years to be built and become fully operational.

One important point that should be emphasised is that although Hurst did not tackle the political consideration of such projects, he was aware of their importance. Therefore, he referred to the fact that these projects would be constructed outside the borders of Egypt to serve its needs. Therefore, he recognised even the possibility of modifying the specifications of these projects to meet the demands and the needs of the countries that would host these projects, namely Uganda and Ethiopia. He stated clearly:

> There is no mention of the agreements which must be made, or of the compensation which might be necessary, in order that works might be built in countries other than Egypt. It is assumed that such agreements can be negotiated in a manner satisfactory to all parties, and it is realised that they may entail some modification in the details of the projects to meet local interests. (Hurst, et al., 1946, p. XIV).

3.1.2 Action Situation: Egypt–Uganda 1949

3.1.2.1 Setting

The publication of the report of *The Future Conservation of the Nile* led to a new wave of diplomatic endeavours by the Egyptian government to secure its water needs. The government officially adopted the proposal included in the report in February 1947. This adoption led to the launch of a new cross-border water

conservation project that became known as the Equatorial Nile Project. As indicated above, this project included the Lake Albert dam, the regulating dam at the outlet of Lake Victoria and the Jonglei Canal. Fortunately, the Ugandan government, or more accurately the British Administration in Uganda, declared in the same year its urgent need of hydroelectric power. This led to a wave of optimism in the Nile Basin as it was believed that the Egyptians and Ugandans had complementary needs

The needs of Egypt and Uganda were to a great extent complementary, however, their governments had different visions of how best to satisfy their needs. On one the hand, the Equatorial Nile Project adopted by the Egyptian government aimed at damming Lake Albert to establish a main reservoir in the lake that would be complemented by a small regulating dam in Lake Victoria. To reach the planned century storage in the reservoir, it would be required to raise the lake level by nearly 13 metres, from 22 metres to 35 metres. It was estimated that this would flood approximately 3500 square kilometres around the shores of the lake. Clearly, the Ugandan government was not in favour of this plan as it would inundate a significant area around the lake. On the other hand, the Ugandan administration planned to construct one dam at the outflow of Lake Victoria to supply it with the urgently needed hydropower. Similarly, this planned Ugandan project did not coincide with the Egyptian plan of building a small complementary dam to work as a regulator of the Lake Albert reservoir. This led the two parties to initiate negotiations over the Equatorial Nile project in 1947.

3.1.2.2 Formal Analysis

The complementarity of objectives between the Egyptian government and the British administration in Uganda was stronger than their differences. The main objective of Egypt was to secure additional water to satisfy its needs. Clearly, from the Egyptian point of view, the optimal mechanism to obtain this water was the construction of a main dam at Lake Albert and a small joint one at Lake Victoria. However, since this plan was supposed to be constructed in the Ugandan territories, the Egyptian government was aware that the whole project would be lost if it did not secure Ugandan approval. Therefore, Egypt was willing to accept modifications in

the project that might result in reducing its additional water supply to save the project. Similarly, since the main objective of the British government in Uganda was to generate hydroelectric power, its best option was to establish a power station that would rely on a small dam at the outlet of the lake. This would enable it to avoid the losses that could be caused by raising significantly the level of lake. However, the Ugandan administration lacked the financial resources to construct such a power station. Therefore, it knew that it was better to meet, at least partially, the demands of Egypt in order to secure the Egyptian financial support to its hydraulic project.

An important key to cooperation in this game was the absence of conflict between the positions of the two actors. Although Egypt fiercely maintained its position as owner of the Nile in this game, it kept its interests focused on the appropriation of additional water supply. On the other hand, the British administration in Uganda positioned itself as beneficiary of the potential hydroelectric power of the river. The absence of conflictive interests in this situation gave rise to a common area of cooperation between the two parties in this action situation.

The available actions in this situation represented another resource provision game. Each actor has the option to sacrifice part of its objective in order to cooperate with the other party. The other option was ignore the other party, maintaining the status quo or even worsening the situation.

The first option for the Egyptian government was to cooperate with the British administration in Uganda in two forms. First, it had to accept modification of its plan for a main dam at Lake Albert and a small regulator at Lake Victoria to a new plan based on a main dam at Lake Victoria that could be complemented by a small one at Lake Albert. The new plan would provide Egypt with less water than what was planned in the original Equatorial Nile Project, but it would be acceptable to Uganda. Second, Egypt needed to provide the necessary technical and financial assistance to Uganda in its Lake Victoria dam and power station. The second option was to insist on the full implementation of the Equatorial Nile project without any modification. This option would open the possibility of inducing Uganda to build a

small power station that operated on the natural flow of water out of Lake Victoria. In this way, Uganda would not be violating the Nile waters agreement of 1929 and would have less financial burden.

For the British administration in Uganda the cooperative option implied two sub actions. The first was to accept a moderate rise in the level of Lake Victoria by building a higher dam than what was needed for the generation of hydroelectric power. This would enable Uganda to supply Egypt with part of its necessary additional water. The second sub-action was to agree on building a small complementary dam at the outlet of Lake Albert to provide Egypt with another share of additional water. The second option was to ignore the Egyptian demands, risking in this way its opportunity to gain the required financial resources for building its planned hydropower station.

Participant	Position	Possible actions
Egypt	The owner of the Nile who needs to increase its water supply from it.	Cooperation: Accepting modifications in the Equatorial Nile Project. Financing hydraulic projects in upstream counties.
		Full implementation of the Equatorial Nile project or maintaining the status quo.
Great Britain	Protector of a beneficiary of the Nile who is interested in the hydrological benefits of the river	Cooperation: Acceptance of a moderate rise in the level of Lake Victoria as a result of the construction of a moderate size dam. Approval of a small complementary dam at the outlet of Lake Albert
		Dismissal of the Egyptian demands.

Table 6-16: Structure of action situation: Egypt–Uganda, 1949.

This was an assurance game with one possible cooperative outcome. This cooperative outcome would involve a compromise by each actor to partially meet the other actor's demands as well as an Egyptian pledge of financial and technical support to the Ugandan dam. The second possible outcome would be the case of default by both participants that would maintain the status quo for both participants in this situation. The two other options would entail one actor fulfilling the other's demands while the other free rides.

The valuations of the payoff of each outcome by each player can be deduced from the context and the setting of the game. On the Ugandan side, the British

administration would prefer the option of maintaining the status quo ($V_{GB\text{-}sq}$) over meeting unilaterally the Egyptian demands ($V_{GB\text{-}GB}$).

$$V_{GB\text{-}sq} > V_{GB\text{-}GB} \qquad (6.23)$$

Moreover, it can be deduced that the mutual commitment of fulfilling each other's demands ($V_{GB\text{-}mc}$) will be valued higher by the British government than cheating on a unilateral Egyptian support ($V_{GB\text{-}EG}$). The logic behind that is that Egypt pledged to provide technical assistance, which gave it the opportunity to monitor the construction and the operation. Therefore, it would be very easy for it to discover any cheating or freeriding. Thus, it could immediately withdraw its support if it discovered that the project design or construction did not meet the agreement. Therefore,

$$V_{GB\text{-}mc} > V_{GB\text{-}EG} \qquad (6.24)$$

A similar pattern of valuations of the Egyptian government can be deduced in this action situation. The Egyptian government would prefer to maintain the status quo ($V_{EG\text{-}sq}$) over providing technical and financial assistance without any return ($V_{EG\text{-}EG}$).

$$V_{EG\text{-}sq} > V_{EG\text{-}EG} \qquad (6.25)$$

It would also value the mutual commitment option ($V_{EG\text{-}mc}$) higher than free riding on a unilateral British acceptance of the Egyptian demands as the latter option will trigger hostility that could induce the other participant to struggle to build a small power station on the natural flow of the river ($V_{EG\text{-}GB}$).

$$V_{EG\text{-}mc} > V_{EG\text{-}GB} \qquad (6.26)$$

This coordination game can be depicted as in Table 6-17:

		Egypt	
		Support provision & compromise	Defect
Great Britain	Compromise	$V_{GB\text{-}mc}, V_{EG\text{-}mc}$	$V_{GB\text{-}GB}, V_{EG\text{-}GB}$
	Defect	$V_{GB\text{-}EG}, V_{EG\text{-}EG}$	$V_{GB\text{-}sq}, V_{EG\text{-}sq}$

Table 6-17: Matrix of action situation: Egypt–Uganda 1949.

As a typical assurance game, each participant will cooperate once he is assured that the other will cooperate too. Otherwise, both parties would prefer to maintain the actual situation.

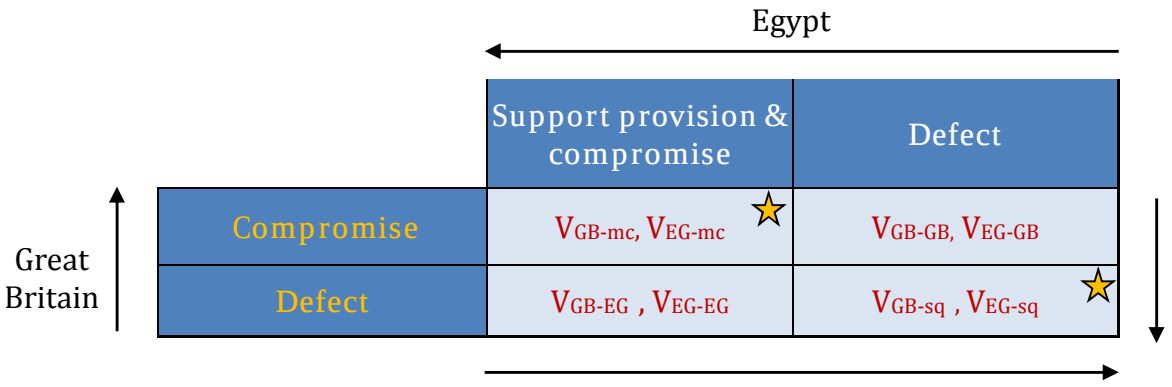


Table 6-18: Matrix of action situation: Egypt–Uganda 1949 – Possible equilibriums.

This assurance was guaranteed by the treaty signed between Egypt and Uganda in 1949, which also took the form of exchange of notes. The treaty included the main technical specifications of the proposed Owen Falls Dam. Moreover, it detailed the Egyptian financial and technical support to Uganda in return for granting Egypt a permanent technical presence to monitor the construction and the operation of Own Dam.

3.1.2.3 Treaty

The treaty formalised the mutual recognition of the Egyptian government and the British administration in Uganda of the development needs of each other. Two formal notes exchanged between the Egyptian government and the British government during 1949 formed what came to be known as the treaty of 1949 on the Owen Falls Dam (appendix: Treaty text). By the means of these notes, the two governments agreed that Uganda would establish a dam on the Owen Falls whose main purpose was hydropower generation. Egypt agreed to provide the necessary technical assistance to Uganda to build and operate the dam. Moreover, Egypt agreed to financial assistance of around 3.65 million pounds sterling to the Ugandan authorities to build that dam in return for raising the level of Lake Victoria by 2 to 3 metres to store the necessary water for Egypt during the dry season. Later, in a third note in 1952 (appendix) Egypt pledged financial assistance of 980,000 pounds sterling as compensation for the loss of hydropower due to the increase in the dam height and lake level. Moreover, the treaty granted Egypt the right to have a resident engineer and appropriate staff to monitor the construction of the dam and consequently to supervise the operation of the dam to guarantee that the dam discharges are regulated according to an annual flow curve that was agreed upon on that time.

Cleary, the agreement between the two countries represented a significant achievement that could pave the way for other projects. One of the main reasons for the success of this agreement was the mutual recognition of their positions. The British administration in Uganda did not deny the Egyptian rights in the Nile water. Even when Uganda threatened to build the dam unilaterally, it was keen to clarify that it would be constructed and operated in a way that respect the Egyptian rights established in the treaty of 1929. Since the treaty granted Egypt veto rights on any upstream project that it believed would alter the flow of the Nile, Uganda declared that the proposed dam would be operated in this case using the natural flow of the Nile. Similarly, Egypt recognised the Ugandan right to benefit from the Nile water. Although Egypt had veto rights on any upstream project that could harm its interests

without any obligation to the building country, Egypt provided Uganda with the necessary technical and financial support for construction of the dam. Moreover, it agreed to compensate Uganda for the modifications of the dam design that were made serve the Egyptian needs.

Moreover, the two governments attempted to resume negotiations over the rest of the projects of the Equatorial Nile in Lake Albert and southern Sudan. Unfortunately, the subsequent civil wars in Uganda and Sudan have practically, frozen the rest of the Equatorial Nile project (Collins, 1990). Nevertheless, this treaty represented a success that proves the possibility of cooperation among riparian countries if they interact collaboratively in a pragmatic manner.

3.1.3 Action Situation: Egypt–Ethiopia, 1920–1940s

3.1.3.1 Setting

The British efforts to build a large dam at the outlet of Lake Tana continued over the first half of the twentieth century. From the publication of the first Garstin report in 1901, the British made several attempts to construct the Tana dam.

The second Garstin reports published in 1904 motivated two failed attempts to reach an agreement with Ethiopia over the Tana dam and reservoir. British officials ignored the repeated warnings of the British agent and irrigation officials in Egypt of the difficulty of reaching an agreement over this dam because of the political conditions. The first attempt came from Lord Cromer himself in 1904 when he attempted to work with Menelek, the emperor of Ethiopia, to draft an arrangement over Tana dam. This arrangement meant to get the approval of Ethiopia for construction of the dam in return for annual financial compensation. However, Cromer communicated his failure the British government in 1907. The second failed attempt came from the British representative in Addis Ababa during the period 1913–1916.

The approval by the Nile Project Commission of the Lake Tana reservoir proposal included in the *Nile Control* report published in 1920 initiated another

serious of British attempts to get Ethiopian concession of the Lake Tana reservoir. The failure of the first two rounds of negotiations with the Ethiopian emperor led the British administration to concentrate its efforts on gaining Italian support for the dam. Moreover, the partial independence of Egypt induced Britain to attempt to exclude Egypt from the negotiation over the Tana dam. Britain's aim was to monopolise the control of the dam in order to use it as a source of pressure on Egypt. Therefore, the British administration wanted to use the Italian ambition to regain Ethiopia to reach a deal of mutual support between the two countries over Ethiopia. The British government believed that in this way it might avoid the Ethiopian resistance to the construction of the dam and use the dam after its construction to apply pressure to the Egyptian government in the future. The British aimed to reach a deal similar to the one of 1891 but Italy should recognise the British rights in Lake Tana and support the reservoir's construction. These efforts yielded a secret agreement between Great Britain and Italy in 1925. The agreement took the form of exchanging notes of mutual support between the two countries. Britain expressed its commitment to recognise Italy's exclusive economic influence in the west of Ethiopia. Italy, in return, agreed to support and assist the British government to gain a concession from the Ethiopian authorities to construct a dam on Lake Tana and to maintain an adequate establishment on the lake to protect the dam as well as permission to maintain a road for the passage of stores and personnel working on the dam. However, these notes were infiltrated through the media to the countries in the Nile Basin. Both Egypt and Ethiopia fiercely opposed this secret agreement because they were ignored in the negotiations and in the signature of the agreement (UNECA, 1995). Moreover, Ethiopia formalised a complaint to the League of Nations of which it was a member at that time. As a result, this agreement was put on ice and the secret plan collapsed. However, this secret plan paved the way for the cooperation between the United States and the Ethiopian regime. The Ethiopian Emperor sought not only technical assistance from the United States but also mediation to reach an agreement with the Egyptian government (Tvedt, 2004). However, this American intervention led the British government to freeze the construction of the dam as a way to prohibit the American intervention in a region considered by the British as their zone of influence (Tvedt, 2004). The Italian

occupation of Ethiopia and the eruption of World War II also contributed to halt the Tana Dam project.

The end of World War II and the publication of the *Nile Control* report led to another attempt to construct the Tana Dam in which Egypt and Ethiopia were the main players beside Great Britain. The failure of the previous attempts convinced the British officials to give Egypt a more significant role in the negotiations to deal with what they considered Ethiopian stubbornness. Moreover, they accepted the Egyptian demand to represent both Egypt and Sudan in the negotiations although there was ongoing conflict between Egypt and Great Britain over the control of Sudan. Furthermore, the British government ignored the warning of the prevalent lack of confidence between the Ethiopians and Egyptians; believing that the success of Egypt in negotiation would also secure Sudanese hydrological interests, which was more important to the British government than the question of representation.

3.1.3.2 Formal analysis

The negotiations between Egypt, Britain and Ethiopia was carried out in an atmosphere of optimism, especially after the conclusion of the Owen Falls dam agreement between Egypt and United Kingdom. It was believed that there was a similarity between the two situations. Egypt was in need of additional water supply for irrigation while Ethiopia was in a similar position to Uganda. Moreover specifically, Ethiopia needed a hydropower station to generate energy for the modernisation of the country. Unfortunately, the negotiations failed and did not yield a similar agreement. Although there were many similarities between the situations, a deeper analysis reveals the informal institutions were different and played an important role in the failure of the negotiations. To understand the role of the informal institutions in this action situation, a hypothetical game situation in which informal institutions would be assumed to be neutral will be analysed, then the same game will be analysed after the inclusion of the role of informal institutions.

3.1.3.2.1 Ethiopia–Egypt: Hypothetical Game

In the absence of informal institutions, the positions of the two actors would be determined by the treaty of 1902 that granted the United Kingdom and Egypt as co-governors of Sudan veto rights in the construction of any irrigation projects on the Blue Nile. Therefore, the positions of Egypt and Ethiopia would be similar to those of Egypt and the British administration in Uganda in the Owen Falls Dam game. On one side, Egypt would use its position as owner of the Nile to gain additional water supply. On the other, Ethiopia would have the position of the potential beneficiary of the future hydroelectric power projects of the Blue Nile. In this case, there would a potential for cooperation owing to the absence of conflict of positions in the game.

Accordingly, the game would be a resource provision game. The cooperative option would entail a compromise by both participants. The other option would be ignoring the other party, thus maintaining the status quo or even worsening it. On the Egyptian side, the first option would be to cooperate with Ethiopia by building the dam but providing Ethiopia with the generated hydropower as well as some financial compensation if needed. The second option for Egypt would be to maintain the status quo. On the Ethiopian side, the cooperative option would entail providing Egypt with the concession to build the dam in return for the generated hydropower. The second option would be to maintain the status quo.

Participant	Position	Possible actions
Egypt	The owner of the Nile who needs to increase its water supply from it.	Construction of the dam
		Maintaining the status quo
Ethiopia	A beneficiary of the Nile who is interested in its hydrological power	Hydropower generation
		Maintaining the status quo

Table 6-19: Structure of hypothetical action situation: Egypt–Ethiopia, 1920–1940s.

This would be an assurance game with one possible cooperative outcome. This cooperative outcome would involve a compromise by each actor to partially meet the other actor's demands. The second possible outcome would be the case of default by both participants that would maintain the status quo for both participants in this situation. The two other options would entail one actor fulfilling the other's demands while other free rides.

In this hypothetical game, the valuations of the payoff of each outcome by each player would be the traditional assurance game. On the Ethiopian side, the Ethiopian government would prefer the option of maintaining the status quo (V_{ETH-sq}) over meeting the Egyptian demands unilaterally ($V_{ETH-ETH}$).

$$V_{ETH-sq} > V_{ETH-ETH} \quad (6.27)$$

Similarly, it would value the mutual commitment of fulfilling each other's demands (V_{ETH-mc}) higher than cheating on the Egyptian side (V_{ETH-EG}). Clearly, Ethiopian default would induce Egypt to withdraw its financial compensation. It would also trigger an atmosphere of hostility that would not be in favour of Ethiopia, especially that Egypt was supported by Great Britain. Therefore,

$$V_{ETH-mc} > V_{ETH-EG} \quad (6.28)$$

Similarly, in the absence of informal institutions, the Egyptian government would prefer the status quo (V_{EG-sq}) over the construction of dam that would later be confiscated by Ethiopia, giving it in this way control over the source of life of Egypt (V_{EG-EG}).

$$V_{EG-sq} > V_{EG-EG} \quad (6.29)$$

It would also value the mutual commitment option (V_{EG-mc}) higher than free riding on the Ethiopian concession of the dam by defaulting on the payment of the financial compensation as the latter option would induce Ethiopia to confiscate the dam (V_{EG-ETH}).

$$V_{EG-mc} > V_{EG-ETH} \quad (6.30)$$

This coordination game can be represented as in Table 6-20:

		Egypt: Support provision & compromise	Egypt: Default
Ethiopia	Compromise	$V_{ETH\text{-}mc}, V_{EG\text{-}mc}$	$V_{ETH\text{-}ETH}, V_{ETH\text{-}ETH}$
	Defect	$V_{ETH\text{-}EG}, V_{EG\text{-}EG}$	$V_{ETH\text{-}sq}, V_{EG\text{-}sq}$

Table 6-20: Matrix of hypothetical action situation: Egypt–Ethiopia 1920–1940s.

Clearly, each of the two countries would cooperate in such an assurance game once it is assured that the other country would cooperate too. Otherwise, both parties would prefer to maintain the actual situation. Therefore, each of the two countries would be in need of a guarantee that the other one would be committed to cooperate in the future.

		Egypt: Cooperate	Egypt: Defect
Ethiopia	Cooperate	$V_{ETH\text{-}mc}, V_{EG\text{-}mc}$ ★	$V_{ETH\text{-}ETH}, V_{EG\text{-}ETH}$
	Defect	$V_{ETH\text{-}EG}, V_{EG\text{-}EG}$	$V_{ETH\text{-}sq}, V_{EG\text{-}sq}$ ★

Table 6-21: Matrix of hypothetical action situation: Egypt–Ethiopia 1920–1940s – Possible equilibriums.

This guarantee would be provided by a formal treaty similar to the 1949Owen Falls Dam treaty between Egypt and Uganda. However, this was not the case. What happened in reality was that Egypt, supported by Britain, and Ethiopia failed to reach to an agreement over the Tana dam and reservoir. Therefore, the following section will provide an explanation for this failure, focusing on the role played by informal institutions in the strategic game.

3.1.3.2.2 Ethiopia–Egypt: Actual Game

Informal institutions played an important role between Ethiopia and Egypt in this action situation. Therefore, it is crucial to identify the state of the two main determinants of informal institutions in the Nile Basin: the religious divide and the ownership of the Nile.

The relationship between Ethiopia and Egypt witnessed an important and decisive phase in its Christian dimension during the period from the 1920s to the 1950s. During this period, the Ethiopian emperor reinitiated the dialogue over the right of Ethiopians to have their own Ethiopian Abuna (Erlich, 2002). This dialogue was induced by two events that occurred in the 1920s. The first was the visit of Ras Tafari, the Emperor of Ethiopia, to Cairo in 1924 mainly to discuss this issue. The Ethiopian emperor viewed this issue as a key determinant in establishing his empire in Ethiopia (Erlich, 2002). The second event was the death of Abuna Matewos, Egyptian Abuna of Ethiopia, in 1926. This dialogue turned into long negotiations between the Egyptians and Ethiopians that fluctuated between friendly and turbulent. The main result of these negotiations was the consecration of the first Ethiopian Abuna in Cairo in 1951. Moreover, this event was preceded by the consecration of five additional archbishops in 1948. This meant not only that the Ethiopian Abuna would be Ethiopian but also the next one would be consecrated by the Ethiopians themselves and not by the Egyptian Church. Although they kept friendly and close relations, these two events marked a practical separation between the Egyptian and the Ethiopian Churches. In other words, the informal institution of the dependence of the Christian Church of Ethiopia on the Coptic Church was seriously weakened. At the same time, the Egyptian King Farouk was attempting to seize upon the fall of the Islamic Caliphate in Turkey in 1920 to declare himself as the Caliph of all Muslims (Fahmi, 2013). In sum, the positive informal institution of Christian dependency was weakened while the negative institution of the Islamic divide was gaining momentum.

The Nile-related institutional framework experienced a conflict between formal institutions and informal institutions. The treaties of 1891 and 1902 granted

Egypt partial ownership rights by granting it and Great Britain a veto right over any construction on the Blue Nile and Atbara rivers. This strengthened the Egyptian informal institution of the ownership of the Nile. At the same time, this new formal institution collided with the Ethiopian informal institution of the ownership of the Blue Nile. Apparently, the new formal institutions could not induce a gradual change in the Ethiopian informal ownership of the Nile. This was very clear in the successive declarations of the Ethiopian emperor after the signature of the treaty in 1902 that Ethiopia had the right to use the waters of the Nile (Tvedt, 2004). Moreover, the Ethiopian emperor contracted a US engineering enterprise, J. G. White and Company, in 1929 to conduct a hydrographic and engineering study of the water resources of Lake Tana and Blue Nile region in Ethiopia (Spencer, 2006). This represented a message to Great Britain and Egypt that Ethiopia was emphasising its rights on the Nile. This message was confirmed when information filtered out in 1941 that the Ethiopian emperor attempted to build the dam independently of Egypt and Britain to use some of its water and to sell the excess to Egypt and Sudan (Tvedt, 2004). Although he failed to do so because of lack of resources, this was another affirmation of the gap between the formal regulation that control the basin and the informal rules that were held by the Ethiopians about the Blue Nile. Again, when the negotiations resumed after the end of World War II, the Ethiopian Vice-Minister for Foreign Affairs sent an aide-memoire to the British government in 1949 which emphasised that Ethiopia was the state whose prior approval of the Tana dam project would be a prerequisite, not that of Egypt or any other country (Tvedt, 2004). In sum, it is clear that the Ethiopians maintained their informal institution of the ownership of the Blue Nile in spite of the veto rights that were granted to Egypt and Britain in the treaty of 1902. At the same time, the informal institution of Egyptian their ownership of the Nile was enforced by the same treaty. This resulted in disequilibrium between formal and informal institutions that governed the Nile Basin in that time (see Diagram 6-8). Moreover, it strengthened the conflict of informal institutions over the ownership of the Nile between Egypt and Ethiopia. Therefore, this conflict of informal institutions played an important role in determining the positions and the strategic choices of Egypt and Ethiopia in this action situation.

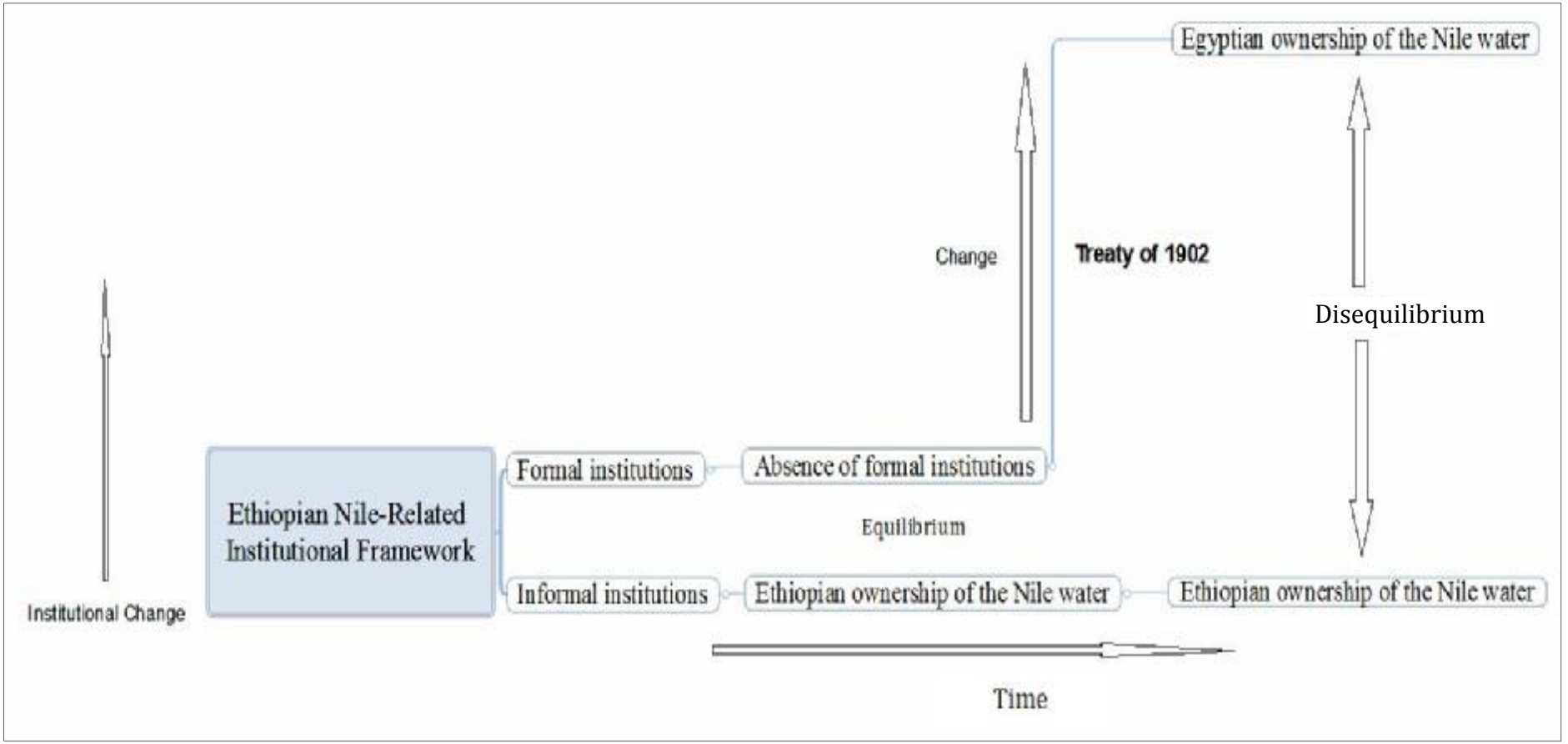


Diagram 6-8: Disequilibrium between formal institutions governing the Nile and Ethiopian informal institutions.

The positions of players is determined in general by the mix of formal and informal institutions that control the action arena. However, informal institutions were a main determinant of the positions of the two actors in this game. Informal institutions affected both nexuses of the relations of Egypt and Ethiopia – religion and ownership of the Nile.

With regard to the religious institutions, the Ethiopian Church gained its independence formally, establishing in this way a new formal institution that weakened its historical relation with the Egyptian Church. Moreover, it resurrected the historical dream of rulers of Ethiopia of being the leader of a Christian empire in Africa. Similarly, the fall of the Ottoman Empire resurrected the Egyptian ambition of being the leader of the Arabic and Islamic world. This informal institution was also strengthened by establishment of the League of Arab Nations in 1945 with its headquarters in Cairo. This put Egypt at the heart of the Arab world and it was believed that it would pave the way to give it the same leading role in the Islamic world. These developments on the religious nexus of the Ethiopia-Egyptian relations widened the gap between the informal institutions of the two countries. Each considered itself as a leader of one of the historically competing empires in the region. Although they did not fall into an explicit confrontation, it became a determining factor in their decisions concerning the Nile water.

With regard to the institution of Nile control, the position of Egypt was more balanced since it was influenced by the combination of informal and formal institutions while the Ethiopian position had been determined mainly by informal institutions. On the Egyptian side, the historical informal institution of the Egyptian ownership of the Nile was reinforced by the treaty of 1902. Therefore, Egypt attempted to use its position as owner of the Nile to gain additional water supply. To the contrary, the Ethiopians rejected this treaty and relied on their informal institution of their ownership of the Blue Nile. Therefore, the Ethiopian government acted as the owner of the Nile with the superior right to benefit from its water while trading the excess benefits with comparable returns. This conflict of ownership had a decisive impact on the strategic choices of the two countries in this game.

Therefore, this game witnessed a conflict of positions between the two actors. Egypt positioned itself as the owner of the Nile water and a potential leader of the Muslim world. Ethiopia acted as owner of the Blue Nile and a potential leader of the Christian empire in Africa. Accordingly, the strategic choices of two actors reflected the positions assumed by the players in the game. Egypt participated in this game primarily as the owner of the Nile, which sought to increase its water supply. Therefore, its available options were to build the Tana dam or maintain the status quo. Ethiopia participated in the game as an evolving Christian empire that wanted to expand its sovereignty over the adjacent territories predominantly inhabited by Christian populations. The Eritrean population was divided between Christianity and Islam. Therefore, Ethiopia sought to annex Eritrea in a federal union ruled by the Ethiopian emperor. Clearly, this became the first option of Ethiopia in the game while the other was the preservation of the status quo.

Participant	Position	Possible actions
Egypt	Owner of the Nile Potential leader of Islamic and Arabic world	Construction of Tana dam
		Maintaining the status quo
Ethiopia	Evolving Christian Empire in Africa Owner of the Blue Nile	Annexation of Eritrea
		Maintaining the status quo

Table 6-22: Matrix of real action situation: Egypt–Ethiopia, 1920–1940s.

This game had four possible outcomes: collective outcome, collective inaction and two free-riding dominated outcomes. First, the cooperative collective outcome involved a compromise by each actor to partially meet the other actor's demands. To gain a concession on the Tana dam, Egypt needed not only to provide Ethiopia with financial compensation for the dam but also to support its claim over Eritrea. Similarly, Ethiopia needed to recognise implicitly the Egyptian rights over Lake Tana

by providing it with the concession for the dam and the technical supervision to Egypt and Great Britain as a co-ruler of Sudan. Ethiopia would receive in return their support for its federation with Eritrea as well as proper financial compensation for the dam. Second, collective inaction would result from the preference of the two actors of maintaining the status quo over cooperation. The two free-riding dominated outcomes would result from having one of the two actor free riding on the cooperating behaviour of the other. Since informal institutions played an important role in defining the positions of participants, the Ostrom framework would be more appropriate to analyse this game (Diagram 6-9).

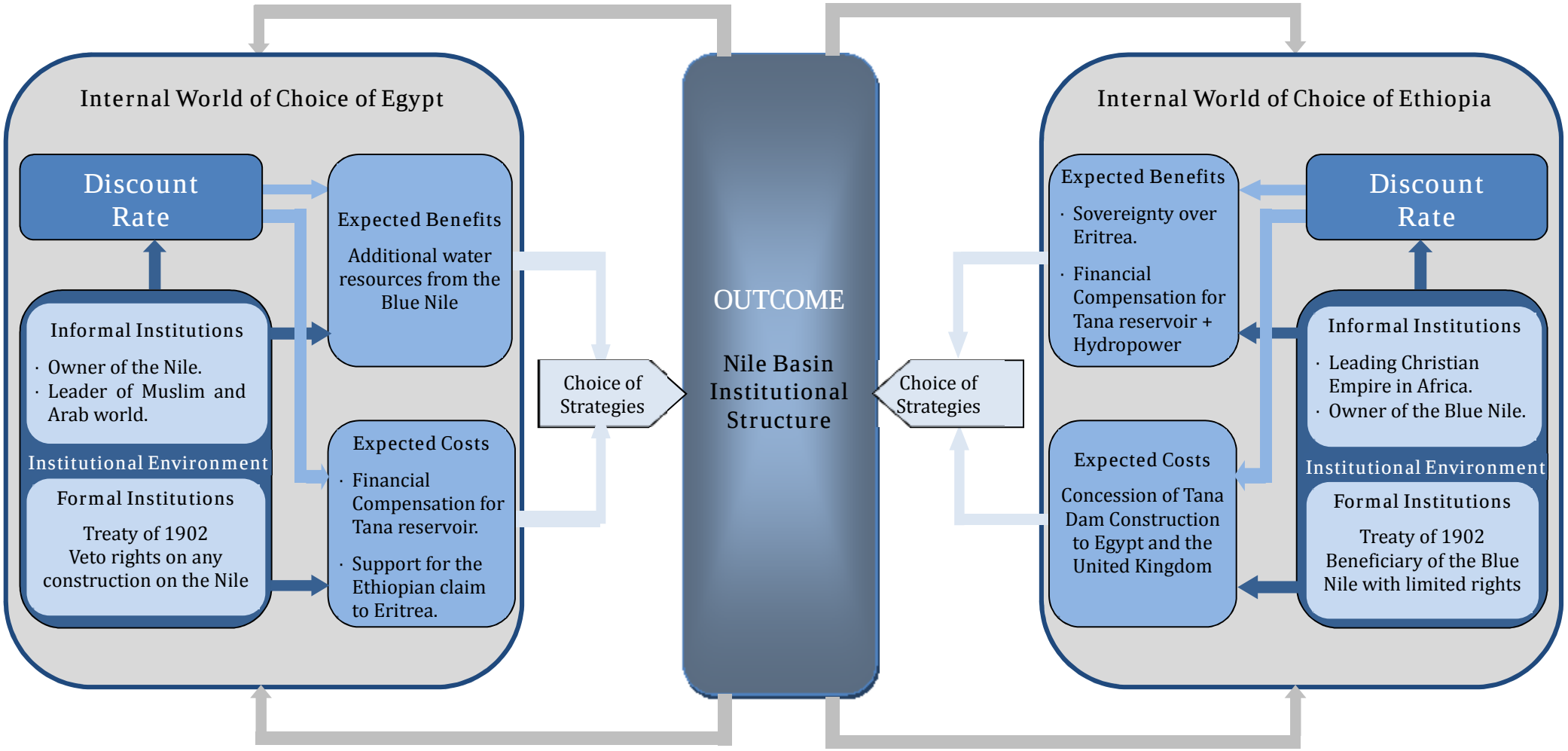


Diagram 6-9: Strategic institutional change: Egypt–Ethiopia 1940s.

In this game, the choice of strategies of each actor depends on his valuation of the net benefit of the payoff. The valuation of each net benefit is determined by the present value of his expected benefit costs of each outcome. With regard to the expected costs, it should be that the more deeply rooted the institution is, the more difficult and costly it is to change (North, 1990). The cost of institutional change is usually time and social stability. Since in the case of discontinuous institutional change the time cost is unavailable, the cost of institutional change would be achieved at the cost of social stability. Therefore, the cost of a sudden change of historical informal institution in a strategic interaction would be valued by actors as extremely high.

On the Ethiopian side, the Ethiopian government would prefer the option of maintaining the status quo ($V_{ETH\text{-}sq}$) over meeting the Egyptian demands unilaterally ($V_{ETH\text{-}ETH}$).

$$V_{ETH\text{-}sq} > V_{ETH\text{-}ETH} \tag{6.31}$$

Similarly, the Egyptian government would prefer the status quo ($V_{EG\text{-}sq}$) over the construction of a dam that would later be confiscated by Ethiopia, thus giving it control of the source of life of Egypt ($V_{EG\text{-}EG}$).

$$V_{EG\text{-}sq} > V_{EG\text{-}EG} \tag{6.32}$$

However, both parties in this game preferred the status quo over mutual commitment. This was a logical result of the high value of the informal institutions inherited in the culture of both the Egyptian and Ethiopian societies. Although Egypt would get additional water resources from the cooperative outcome, the cost of sacrificing Muslim-inhabited territories to the Christian Empire of Ethiopia would be very high. Public opinion would not accept it and it might lead to social unrest. Therefore, although Great Britain declared its support for the Ethiopian Federation hoping that the Ethiopians would give Britain and Egypt the concession for the Tana dam, Egypt could not provide such support to Ethiopia. Britain declared its support for the federation of Ethiopia and Eritrea, with the exception of the Muslim Western

Province, Justifying this support by the religious and racial kinship between the inhabitants of Ethiopia and those of the Coptic Highlands of Eritrea (Tvedt, 2004). However, Egypt knew that Muslim inhabitants were scattered over the Eritrean territories. Therefore, it was difficult for Egypt, the potential leader of the Islamic and Arabic world, to concede the Muslim-inhabited territories to the Christian Ethiopia, especially the Muslim-inhabited province of Massawa that was under Egyptian rule in the nineteenth century. Therefore, the cost of such mutual commitment was seen by the Egyptian government as higher than the expected benefits in water, especially after the conclusion of the treaty of the Owen Falls Dam which was seen as the beginning of the Equatorial Lakes century storage project. Moreover, Egypt perceived itself as the owner of the Nile by both history and international law. Therefore, Egypt did not commit itself to recognise the annexation of Eritrea to Ethiopia in return for additional water resources ($V_{EG\text{-}mc}$). Moreover, it gave some oral promises of future support for the Ethiopian-Eritrean federation during the negotiations but it never materialised these promises in an official commitment (Tvedt, 2004). It hoped for a unilateral Ethiopian concession of the Tana dam ($V_{EG\text{-}ETH}$), in return only for financial compensation. Therefore, it was clear that Egypt preferred a unilateral Ethiopian concession of the dam for Egyptian financial support over the mutual commitment option:

$$V_{EG\text{-}ETH} > V_{EG\text{-}mc} \qquad (6.33)$$

Similarly, while the Ethiopian government demanded Egyptian recognition of its federation with Ethiopia, it rejected the idea of full Anglo-Egyptian control over the dam. Ethiopia perceived Eritrea as a historical part of its empire and therefore did not accept the high cost demanded by Egypt, which was partially sacrificing its ownership of the Nile. Therefore, Ethiopia sought to maintain its authority over the dam rather than having only the right to benefit from its generated hydroelectric power. In other words, it sought a unilateral Egyptian recognition of the annexation of Eritrea while Ethiopia would maintain its control over the dam, maintaining in this case the ownership of its water to sell to Egypt or Sudan. Clearly, it would provide Egypt and Sudan with a share of its water in this case in return for the cost of construction being assumed by Egypt. Therefore, it could be deduced that

Ethiopia preferred to have a unilateral recognition of the Ethiopian-Eritrean federation ($V_{ETH\text{-}EG}$) over the mutual commitment ($V_{ETH\text{-}mc}$) that would entail partial sacrifice of its sovereignty over Lake Tana and its reservoir.

$$V_{ETH\text{-}EG} > V_{ETH\text{-}mc} \qquad (6.34)$$

This game would be represented as in Table 6-23:

Ethiopia \ Egypt	Cooperate	Status quo
Cooperate	$V_{ETH\text{-}mc}$, $V_{EG\text{-}mc}$	$V_{ETH\text{-}ETH}$, $V_{EG\text{-}ETH}$
Status quo	$V_{ETH\text{-}EG}$, $V_{EG\text{-}EG}$	$V_{ETH\text{-}sq}$, $V_{EG\text{-}sq}$ ★

Table 6-23: Matrix of real action situation: Egypt–Ethiopia, 1920–1940s - Equilibrium.

As depicted above, this is a game of prisoners' dilemma where the two actors reached a Nash equilibrium which was suboptimal from the social point of view. Both countries preferred not to cooperate and the negotiations failed. Consequently, this triggered a new stage in the Nile-related relationship between Egypt and Ethiopia. In this new stage, each of the two governments attempted to pursue its plans unilaterally. In 1951, the Ethiopian emperor sought the support of the United States to build the dam without the involvement of Egypt (Tvedt, 2004). Similarly, Egypt started to modify its plans for control of the Nile to rely on projects that would be constructed within the Egyptian borders to limit its dependence on the other Nile riparian countries.

4 The Nile Basin Institutional Structure – 1954

Although this phase did not witness the integration of various formal institutions, the institutional changes introduced were very influential in the Nile Basin structure. With regard to the formal institutions, the treaty of the Owen Falls Dam represented a creative formal institution that redefined the Nile water as a multi-benefit good. However, the developments in Egyptian-Ethiopian relations during this phase widened the gap between the informal institutions of the two countries.

The only formal institution that was integrated in the Nile Basin structure was the treaty of the Owen Falls Dam, agreed in 1949. This treaty did not tackle the water appropriation rights between the riparian countries. However, it had a significant impact as it redefined the Nile water as a multi-benefit good. With the same annual amount of water, the treaty provided Egypt punctually with irrigation water to meet its needs in the dry season while providing Uganda with the hydropower it needed, generated by the same water flow. The multiplicity of the benefits of the water represented the basis for a pragmatic cooperation between the two countries. The neutrality of the informal institutions between Uganda and Egypt facilitated this pragmatic pattern of cooperation that was based on the mutual benefits for the two parties.

To the contrary, informal institutions constrained the cooperation between Egypt and Ethiopia. An important development in this institutional environment was the success of Ethiopia in weakening its informal institution of dependency on the Egyptian Coptic church by having its own Abuna. Moreover, this phase witnessed the intensification of the conflict between Egypt and Ethiopia over the ownership of the Nile. Despite the veto rights granted to Egypt by the formal institution of 1902, Ethiopia maintained its historical institution of its ownership of the Nile. Therefore, the institutional environment that governed the Egyptian-Ethiopian relations experienced from that time a disequilibrium of the formal and informal institutions.

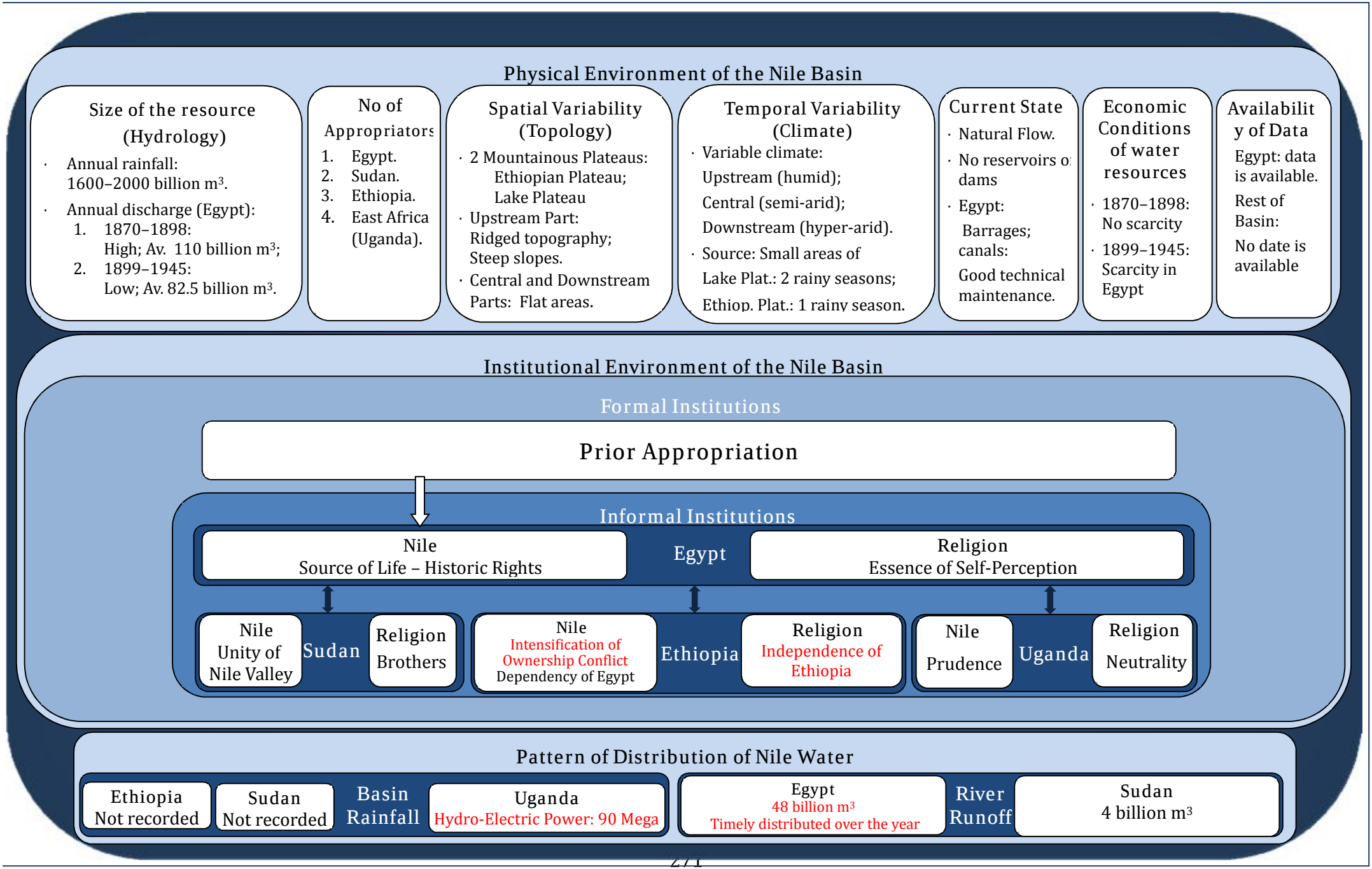


Diagram 6-10: The Nile Basin institutional structure – 1954.

4.1 Egyptian National Institutional Environment: 1954

This section explores the benefits to the Egyptian people of the Nile Basin-wide institutional changes. More specifically, it will analyse how the benefits of the change in the Nile Basin's institutional structure filtered through the different levels of the Egyptian institutional environment to the Egyptian people.

The basin-wide institutional changes during the period from 1882 to 1954 represented two main achievements for Egypt. First, the informal institutions of the Egyptian ownership rights on the Nile water were formalised through a series of treaties with the Western colonisers or with the riparian countries. This prepared the way for the second achievement, which was the implementation of basin-wide projects to control the Nile water in order to secure a stable supply of water to Egypt over the year. However, this achievement was incomplete as Egypt did not succeed in carrying out its century storage project, which would increase its water supply and guarantee it a constant supply over years, until the end of this period.

Therefore, the main economic benefit of these institutional changes for Egypt was its success in securing a regulated water supply over the year. This enabled it to continue its projects to expand its cultivable land and, more importantly, to transform the agricultural sector to perennial irrigation to increase the productivity of its cultivable land. The following section attempts to trace the influence of the different layers of the Egyptian institutional environment on the benefit accrued from these changes to people either directly through the agriculture sector or through the redistributive policy of the state materialised by its social sector.

4.1.1 Formal Macro Institutions

The new formal institutions introduced in this period that affected the benefits of the Nile water were not limited to the agricultural sector as was the case in the preceding period. The first reason for that was the fact that the Egyptian economy started to be an export-based economy. This linked the benefits from the

agriculture sector with the revenues from the exportation of the agricultural production. The second reason was that the Egyptian government attempted gradually to employ the surplus of its agriculture sector to structurally transform its economy towards industrialisation. Finally, towards the end of this stage, the Egyptian state started to carry out its social role towards its citizens by introducing legislation that institutionalised the role of the state in the social sector.

With regard to the agriculture-related institutional environment, this period witnessed the enactment of two important irrigation laws. The first was enacted in 1903 to organise the geographical distribution of irrigation periods over the year (Al-Kadi, et al., 1987). It also regulated the distribution of the crop production over the Egyptian cultivation period (Al-Kadi, et al., 1987). This law had a significant positive impact on raising the efficiency and productivity of the agriculture sector. The second law was introduced in 1942 to regulate the fees for use of irrigation facilities and machines by farmers (Al-Kadi, et al., 1987). The law introduced a two-level fee for irrigation water (Al-Kadi, et al., 1987); the irrigation water that flows naturally to agricultural lands was free of any charge while a fee was payable on the water provided by the new irrigation projects and machinery (Al-Kadi, et al., 1987). The main philosophy of the law was to make agricultural landowners assume part of the costs of the irrigation projects to allow the government to continue its irrigation reform policy (Al-Kadi, et al., 1987). This was the first time in Egyptian history a levy was put on the water that was used for irrigation. This new formal institution resulted in economic gains in the efficiency of using water and also provided the government with a significant additional financial resource to its revenues.

The second segment of the national institutional environment that influenced the Nile-related benefits was the formal institutions of foreign trade. Egypt had a full free trade regime since 1840 that give foreigners all the freedoms of investment and trade (Hansen & Nashashibi, 1975). This regime was institutionalised by the Treaty of London signed by the Viceroy of Egypt Mohammed Ali and the Western powers in1840. The treaty limited import duties to a flat rate of

5% (Hansen & Nashashibi, 1975). This regime allowed the Egyptian economy to grow as an export economy that relied mainly on agricultural exports, especially cotton. Therefore it recorded continuous growth that enabled Egypt to repay its debts and accumulate foreign reserves (Hansen & Nashashibi, 1975). However, this constrained the economic structure to the agriculture sector. Therefore, as soon as Egypt gained its partial independence from the British in 1922, it embarked on an industrialisation process focused on the processing sector of its agriculture production, such as textiles, fertilisers and sugar. To achieve that, it resorted to reform of its tariff system to protect its infant industries by enacting a new foreign trade legislation. This new formal institution maintained the import tariff of raw materials, fuel and semi-manufactured goods at almost the same old level with a slight increase of 1% to reach 6% while raising the tariff on imports of manufactured goods to 30% (Hansen & Nashashibi, 1975).

	Estimated Population (millions)	Cultivated area (1000 feddans)	Per capita cultivated area	Cropped area (1000 feddans)	Cropping intensity (%)	Per capita cropped area
1897	9.717	4943	0.53	6725	136	0.71
1907	11.190	5374	0.48	7595	141	0.67
1917	12.718	5309	0.41	7729	145.5	0.60
1927	14.178	5544	0.39	8552	154	0.61
1937	15.921	5312	0.33	8302	156	0.53
1947	18.967	5761	0.31	9133	158.5	0.48

Table 6-24: Agricultural production in Egypt, 1897–1947 (Waterbury, 1979).

As a result, the Egyptian economy experienced continuous growth accompanied by a gradual structural transformation during the period from 1930 to 1950. The growth was supported also by the fact that Egypt acted as a supplier of

goods and services to the Allies during World War II owing to worldwide shortages. Therefore, the economy grew at a rate of above of 5% in most years, with a maximum of 13% reached in 1948 (Hansen & Nashashibi, 1975). The structural transformation led to an increase in the industrial share from less than 5% of GDP at the end of the nineteenth century to around 18% in 1952, while the share of agriculture declined from more than 50% of GDP at the end of the nineteenth century to around 38% in 1952 (Hansen & Nashashibi, 1975). This did not mean that agricultural production declined: it was continuously growing but at a slower rate than the growth of the economy. However, since it was also growing more slowly than the rapidly growing population (Table 6-24) this led to the inclusion of food in Egyptian imports starting from the 1930s. In 1952, imported food represented 23% of the total of Egypt's imports (Hansen & Nashashibi, 1975). Moreover, the shortage of food supplies worldwide during World War II induced the government to carry out a reform in its institutional environment to regulate its social sector. To be more accurate, this institutional reform introduced the first redistributive social policy in modern Egypt.

Although this reform in the institutional environment aimed at introducing a limited social policy that focused on the provision of universal food subsidies during World War II, it paved the way for a broader future social policy (World Bank, 2010). The food subsidy became permanent and included more items. Moreover, the social policy of Egypt included universal provision of education and selective intervention in the health care sector.

In 1942, legislation was enacted to provide food ration cards which started as a temporary measure to guarantee all citizens sufficient quantities of basic food items and to help them to overcome the scarcity and inflation caused by World War II (Gutner, 1999). However, the food subsidies have persisted since then and have never been transformed into targeted subsidies. After the 1952 Revolution, the Egyptian state started gradually to restore its ancient role in the agricultural sector. It embarked on agricultural reform, institutionalised by Law no. 178 of 1952, which imposed heavy government intervention in purchasing, storing and distributing the major agricultural products (Ahmed, et al., 2001). Moreover, the government made

explicit that one of its essential mandates was to provide basic food items for people at subsidised prices (Gutner, 1999). Since then, Egypt's food subsidies have included two programmes: a universal subsidy programme that was directed to subsidise bread which was to be sold at subsidised price to all citizens; and a targeted subsidy programme that relied on ration cards that provided fixed monthly quotas of basic food items to the holders of these cards (World Bank, 2010).

Until the early 1950s, the formal Egyptian institutional framework did not include universal free public provision of education and health care. Concrete efforts for establishing formal regulations and policies for providing free universal access to education and health care started after the 1952 Revolution (Tadros, 2006). In education, universal access to education was one of the early accomplishments of the regime after the revolution. A national strategy for universal access to education was instituted in 1953 followed by Law no. 214 in the same year which made all levels of education free of charge to Egyptians (Tadros, 2006). In contrast, until the end of this phase, health care provision was not declared by the government to be the responsibility of the state (Tadros, 2006). However, the government started a plan to provide public health services gradually to Egyptian citizens.

4.1.2 Micro Institutional Structures

The main achievement on the micro organisational level was the centralisation of the scattered government bureaucracies as a result of the partial independence of Egypt. A single entity named the Irrigation Authority, which later became the Ministry of Irrigation and Water Resources, became responsible for all irrigation and water issues. A single Ministry of Industry was created for all industry-related organisation matters. Similarly, food subsidies were controlled by the Ministry of Trade and Supply (MOTS). The Ministry of Education (MOE) was responsible for designing, printing and providing educational materials, and for monitoring and evaluating the educational process (El Baradei & El Baradei, 2004). The Ministry of Health (MOH) was responsible for health care regulation and monitoring. Health care services were mainly provided by private hospitals.

However, it should be noted the Egyptian administration played a limited role in the economy and social sector. The Egyptian economy was still a capital economy that relied on the foreign and domestic private sector. Similarly, the social policy tools were very limited. Although the regulation of subsidies and universal education provision were enacted, the relevant ministries had very limited budgets to implement them.

4.1.3 Individual Level

Although Egypt during this period gained far better regulated water resources, Egyptians had limited benefits from it. The benefits of the water extended beyond the irrigation and drinking water sector to the industrial sector. However, the pattern of land ownership that persisted from the nineteenth century constrained the positive impact on the capabilities of the majority of Egyptians. Although the government intended to implement a redistributive social policy to compensate for this deformed ownership pattern, the lack of resources and sufficient proper public planning limited the impact of this policy.

Although the inherited landholding pattern of the nineteenth century experienced some changes, the main beneficiaries were the elite of the society and foreigners. Furthermore, this unbalanced ownership was extended to the growing industrial sector. Therefore, by the end of this 1940s, just 0.5% of the population held more than 90% of the agricultural and industrial properties in Egypt. A little more than 150,000 people owned almost the whole of the agricultural land in Egypt at the beginning of 1950. With the exception of small plants, the majority of industrial plants were owned by a limited number of families.

The main positive development of this stage was the evolution of a middle class in the urban areas that was employed by the expanding industrial and services sector. The share of the labour force in the industrial sector increased from 6.2% to 8.1% of the total labour force during the period from 1937 to 1947 (Mabro, 1967). The main services that increasingly absorbed the labour force were the growing governmental sector, construction and transport. Therefore, the share of the

services sector in the total labour force increased from 24% in 1937 to 28% in 1947 (Mabro, 1967). The significance of these changes in the service sector were in the quality of the new services that absorbed the labour force. These new services were much more developed and offered higher wages than the old traditional service such as petty trade. This evolution in the industrial and services sector led to a decline in the share of the agricultural sector in the total labour force. Although the size of the agricultural labour force stabilised at around 4 million persons during the period from 1937 to 1947, its share of the total labour force declined from 69% to 59% (Mabro, 1967). Moreover, since manufacturing and services were concentrated in the urban areas, Egypt witnessed a considerable migration from rural to urban areas. Therefore, the urban population grew at an annual rate of 4.3% during the period 1937–1947 compared with an annual growth rate of 1.8% for the total population during the same period (Mabro, 1967).

These developments created a middle class that worked mainly in the industrial and services sector and inhabited mainly the urban areas. This newly developed class benefited from the growing industrial wages and the better serviced urban zones. While the agricultural labour wage stagnated during the 1930s and 1940s, the nominal wages increased by around 240% during the period 1937–1950 while the real income of industrial labour increased by around 20% during the same period. Moreover, they enjoyed the ambitious plans motivated by the surplus the Egyptian government accumulated during World War I and World War II to provide urban areas with the basic services of clean water and electricity as well as a few facilities for public education and health services in the central urban zones.

Therefore, Egypt became divided into three main classes. The ruling elite controlled the majority of wealth sources and gained most from the improved Nile water utilisation that led to the continuous growth of the Egyptian economy. A limited middle class that benefited from the work opportunities in the new industrial and governmental sectors. This class started to live in the urban zones and central cities. This enabled them to benefit from the centralised supply of drinking water, limited opportunities of subsidised education and health services. Finally, the majority of Egyptians who remained as farmers and peasants in the rural areas

maintained their subsistence livelihood. Deaths resulting from malnutrition and poor health care remained common among them.

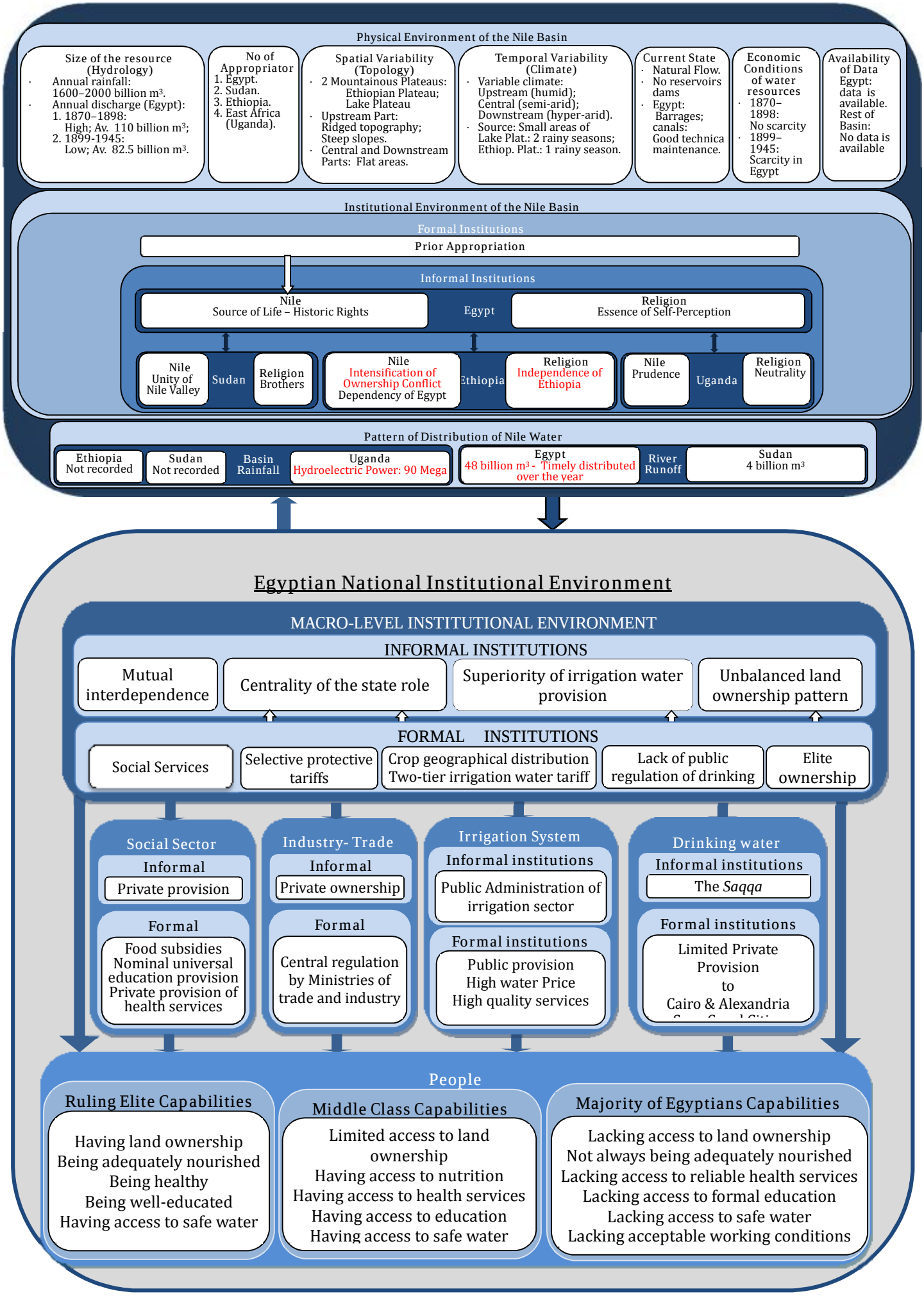


Diagram 6-11: The Nile Basin institutional structure – Egyptian Institutional Environment 1954.

5 Conclusions

The increasing scarcity of water resources at the end of the nineteenth century induced Egypt to search for additional water resources to meet the needs of its growing economy and population. After its occupation of Egypt in 1882, Great Britain supported the Egyptian efforts as co-beneficiary of the Egyptian agriculture sector. Therefore, Britain expanded its control to most of the Nile Basin territories, with the exception of Ethiopia, during the last decade of the nineteenth century and the first decade of the twentieth century. Consequently, Egypt and Britain started their efforts to secure the usual water share that Egypt received at that time. In a later stage, they worked to increase this share by implementing water control projects in the upstream territories.

During the first phase of this period, which extended until the end of the 1920s, Egypt succeeded in formalising its traditional share of the Nile water. The presence of the British government in the strategic interaction of Egypt with other riparian actors had three positive consequences for Egypt. First, it strengthened its position in these strategic interactions. Second, and more importantly, it neutralised the role of historical informal institutions between the riparian actors in these interactions. Since the British government always acted as representative of one of riparian participants in all of these interactions, the joint riparian informal institutions had no presence in these interaction. In the strategic interactions over the Blue Nile with Italy in 1891, then Ethiopia itself in 1902, Britain negotiated on behalf of Egypt. Therefore, the strategic choices of the participants in these two strategic interactions were very close to the pragmatic rational choice owing to the absence of common history in the basin between the participants. Similarly, in the strategic interaction of 1929, the British government represented the Upper Nile actors, including Sudan and Uganda, in their strategic interaction with Egypt. Therefore, it was a case of pragmatic rational interaction between Egypt and Britain in which they were able to reach a cooperative deal acceptable to both of them. Last but not least, Britain used the issue linkage technique to exchange concessions as a strong colonial power for securing its water interests. It recognised the Italian

presence in Eritrea and Ethiopia twice, in 1891 then 1925, to secure its water interests in the Blue Nile and Atbara. Similarly, it recognised the sovereignty of Ethiopia and supported its ruler in return for his signature on the treaty of 1902. However, a similar attempt by Ethiopia to gain Egyptian recognition of Ethiopian sovereignty on Eritrea failed because of the conflict of their historical informal institutions.

The role of informal institutions appeared gradually during the second phase of this period which extended from the early 1930s until the end of this period with the full independence of Egypt in1954. This phase aimed at securing additional and timely water over the year and stabilising the annual water supply of Egypt. This phase witnessed two strategic interactions. One interaction was between Egypt and Uganda that led to the treaty of Owen Falls Dam in 1949. The second one was between Egypt and Ethiopia that took place during the 1940s and failed to reach any conclusive result. The neutrality of the common informal institution between Egypt and Uganda, "the unknown other", as well as the British presence in this strategic interaction, helped to reach a cooperative settlement to this strategic interaction. To the contrary, the conflict of informal institutions between Egypt and Ethiopia hindered the possibility of reaching a cooperative solution between them. The competitive religious informal institutions and the conflictive informal institutions of Nile ownership thwarted their opportunity to reach an optimal cooperative settlement that could allow them to share the different benefits of the Nile.

In general, the basin-wide institutional changes during the period from 1882 to 1954 had two main achievements for Egypt. First, the informal institutions of the Egyptian ownership rights on the Nile water were formalised through a series of treaties with the Western colonisers or with the riparian countries. Second, the effective water supply of Egypt increased and became more regulated and distributed over the year as a result of the signature of the treaties of 1929 and 1949 with Great Britain. This enabled the Egyptian economy to achieve continuous growth during this stage of the study period. Moreover, the Egyptian government

was able to initiate a process of structural transformation to build an industrial base for the Egyptian economy.

However, this economic growth had limited impact on the capabilities of the majority of the Egyptian population. Only the ruling elite class was able enhance its capabilities through accumulating wealth that allowed them to have access to safe water and food, productive education, and high-quality health services. Another class that had limited benefits from this growth was the middle class, which grew during the second phase of this period. This evolving class was able to enhance their capabilities of learning, working and having the basic services mainly as a result of working in the growing industrial and governmental sectors and living in the urban zones that enjoyed an acceptable level of basic services. Unfortunately, the majority of Egyptians worked as waged farmers in the agricultural rural zones. Therefore, they did not achieve much improvement either in their livelihood capabilities or their learning capabilities, which could have improved their future. Therefore, it can be concluded that although the basin-wide institutional change in the Nile Basin had a positive impact on the water resources of Egypt, its impact on the capabilities of the majority of the Egyptians was limited by the unbalanced Egyptian institutional environment.

CHAPTER 7

POST-COLONIAL PERIOD: 1954–1990

This chapter studies the strategic interactions among the riparian countries during the post-colonial period. The chapter begins by briefly exploring the institutional structure of the Nile Basin at the beginning of the post-colonial period. Consequently, it presents the gradual evolution of the institutional environment during this period. Furthermore, the strategic interactions among the studied riparian countries are analysed. Finally, the impact of these changes on the on the Egyptian institutional environment and the capabilities of the Egyptian population are traced. Some remarks and conclusions are presented at the end of the chapter.

1 The Nile Basin Institutional Structure – 1954

This section begins by analysing the conditions of the physical environment of the Nile Basin, which represents the first layer of this structure. Moreover, it will briefly relate these conditions to the actions of the riparian countries during this period. Secondly, it examines the institutional environment of the Nile Basin. Finally, this section will study the interaction between the physical environment of the basin and its institutional environment to assess their impact on the allocation of the water of the Nile Basin.

1.1 Conditions of Physical Environment of the Nile Basin

Although the Nile did not experience a change in its natural conditions during the colonial period, the human efforts modified slightly its physical characteristics. These efforts attempted to achieve three main objectives. First, the need to increase the amount of its utilisable water to overcome the decline of annual discharge of the Nile and the seasonable variability of this discharge. Therefore, some regulatory structures were built during the British colonial period on the course of the river to achieve this goal. However, the quantity of water stored by these dam structures was still below that needed by Egypt and Sudan. The second objective of these efforts was to maintain a relatively constant annual water supply for the downstream countries. Finally, another objective was to generate hydroelectric power to meet the

needs of the riparian countries, especially the upstream countries. However, these efforts resulted in constructing only one dam whose main purpose was hydroelectric power generation. Therefore, the need to build such types of dams intensified in the beginning of the post-colonial period.

The first challenge faced by the downstream countries, Egypt and Sudan, was the decline in the annual discharge of the Nile. As indicated in the previous chapter, the average annual discharge of the Nile declined from 109.775 billion cubic metres during the period 1871–1898 to 82.6 billion cubic metres during the period 1899–1945 (Hurst, et al., 1946). Although the annual discharges improved slightly during the second half of the 1940s and the 1950s, the average annual discharge level remained around 83.858 billion cubic metres[4] for the period 1900–1859 (Hurst, et al., 1966). Therefore, it became accepted by the end of the 1950s that the Nile had experienced a long-term decline in its annual water discharge (Diagram 7-1).

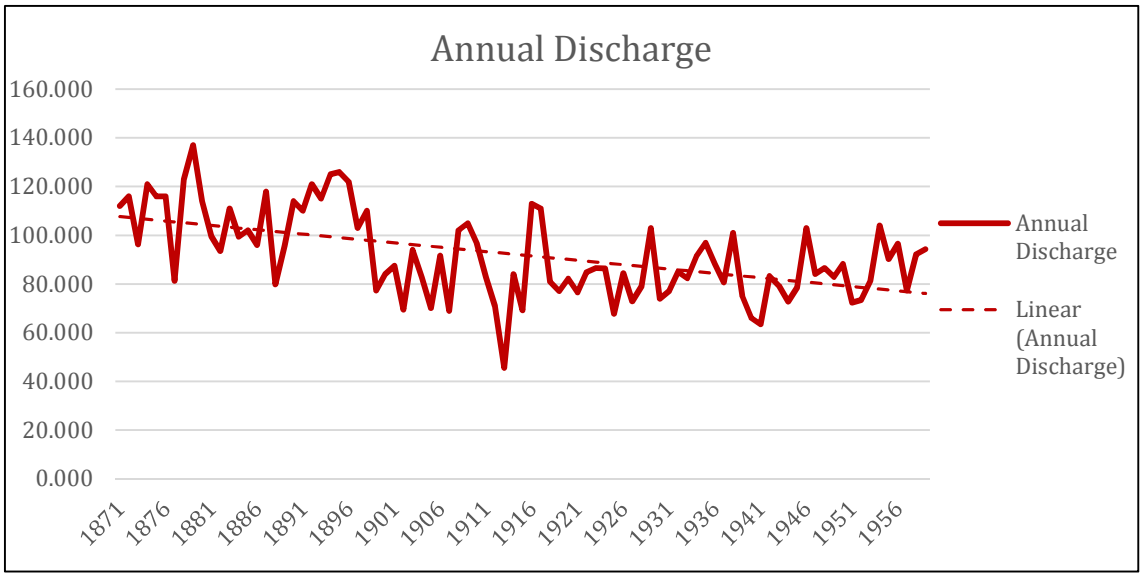


Diagram 7-1: Annual discharge of the Nile in billion m³, 1871–1959.
Source: Hurst et al. (1966).

Moreover, not only had the Nile suffered a decline in its annual discharge, but this annual discharge was also characterised by a seasonal variability, with a relatively dry summer season. The growing agricultural sector in Egypt and Sudan

[4] The 60-year average annual discharge of the period 1900–1959, approximately 84 billion cubic metres, has become accepted as the average annual discharge of the Nile until today.

had increased water requirements, especially during the summer season for cotton cultivation. However, only 15.4 billion cubic metres on average was timely water that was used in irrigation in Egypt and Sudan (Hurst, et al., 1946). However, the additional summer water requirement of Egypt was estimated to be at least 28 billion cubic metres (Hurst, et al., 1946). The additional summer water requirement of Sudan was estimated to be around 2 billion cubic metres (Hurst, et al., 1946). Therefore, there was a need to develop storage facilities on the Nile to store at least 30 billion cubic metres. However, if we bear in mind that the widely-accepted figure for the average total discharge of the Nile is 84 billion cubic metres then the above indicated amount of timely water represented nearly 20% of the supply needed. Furthermore, it was agreed that at least 20% of the annual discharge was untimely and un-storable as it came at the peak of the flood (Waterbury, 1979). Therefore, only 60% of the total annual discharge was untimely but storable, at least in theory (Waterbury, 1979). In other words, there was a possibility of storing around 50 billion cubic metres of the total annual flow of the Nile.

Therefore, Egypt attempted to increase the amount of utilisable water of the Nile to overcome this double challenge. Several proposals for the establishment of various seasonal storage reservoirs were presented, as explained in the previous chapter. However, only three of these proposals were implemented. The first was Aswan Dam, which became known later as Aswan Low Dam, which was completed in 1902 with a storage capacity of 1 billion cubic metres. Aswan Dam was raised twice, first in 1912 and again in 1933. The first raised its height by 5 metres, increasing its storage capacity to 2.5 billion cubic metres (D. , 1913). The second increased its capacity from 2.5 billion to 5 billion cubic metres (Collins, 1990). The second dam was the Sennar Dam on the Blue Nile. This dam was completed in July 1925 and provided water for the Gezira scheme, which was hence used mainly for growing cotton in Sudan (Collins, 1990). The height of the dam was 39.6 metres at the time of its completion. Its storage capacity was about 0.6 billion cubic metres (Hurst, et al., 1946). Finally, Gebel Al-Awliya Dam was constructed on the White Nile between 1932 and 1937 to provide Egypt with around 3.5 billion cubic metres of water during the summer season. However, it ended up providing around 2.5 billion

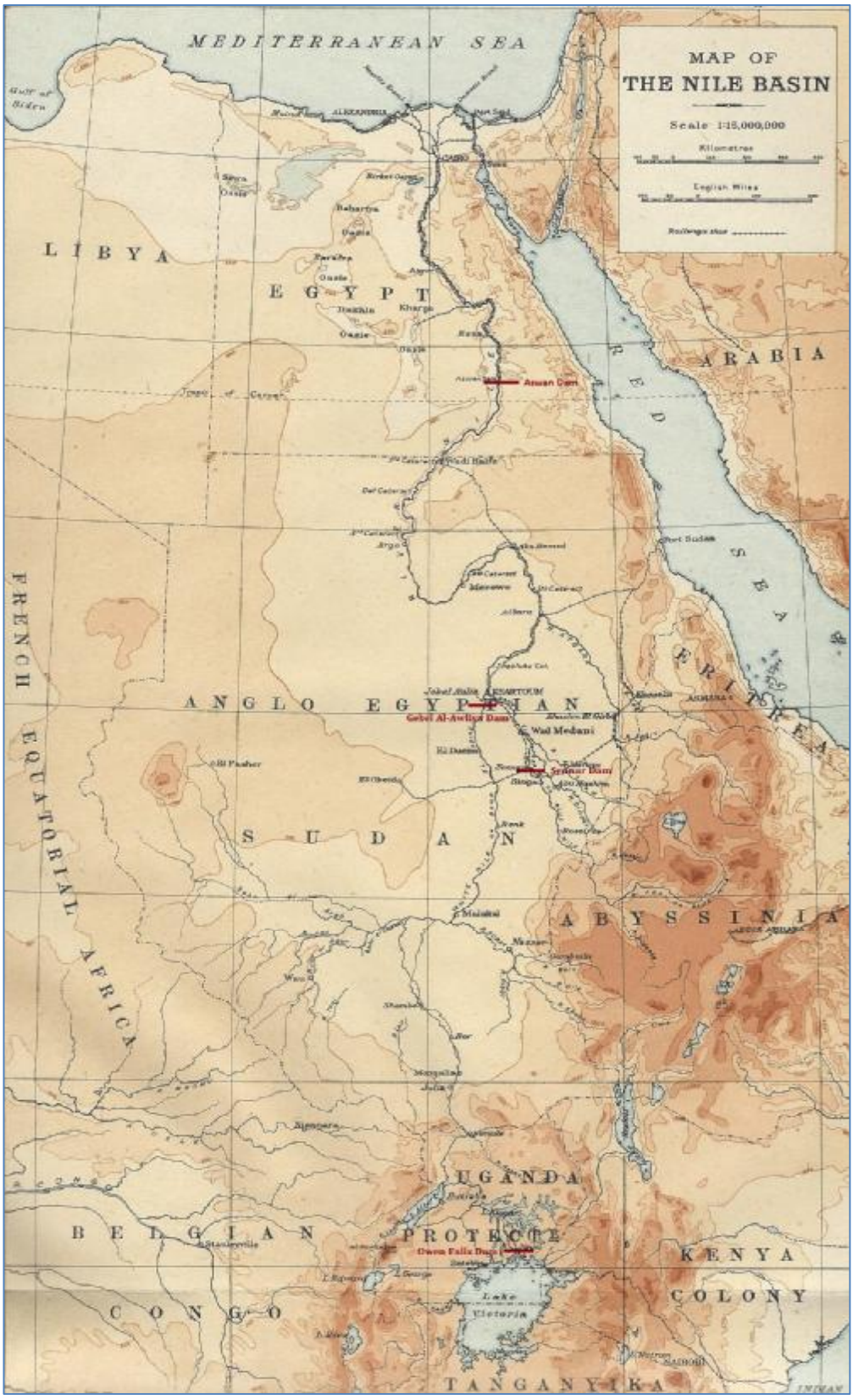
cubic metres owing high loss from surface evaporation (Hurst, et al., 1946). Therefore, the total storage capacity of these three dams was 8.1 billion cubic metres, which was not only far below the additional water requirements of Egypt and Sudan but also less than 20% of the untimely storable water of the Nile.

The second objective of the Egyptian efforts was to secure a constant annual water supply sufficient to satisfy its total water requirements. The recorded annual discharges of the Nile during the period 1871–1959 reveal that the fluctuations in the total annual discharges of the Nile are substantial (Diagram 7-1). As shown in Table 7-1, the standard deviation figures demonstrate that these fluctuations are significant and can have damaging effects on the agriculture sector. Two extreme cases demonstrate the devastative effect of such substantial fluctuations. The first was recorded in 1879 when the annual discharge of the Nile reached 139 billion cubic metres, causing a flood that damaged vast agricultural areas in Egypt. The second was a case of drought recorded in 1913 when the annual discharge did not exceed 45 billion cubic metres, leading to significant agricultural losses in Egypt in that year. Therefore, Egypt adopted the ambitious century storage plan, or Equatorial Nile projects, to maintain a relatively constant annual water supply for it and Sudan. The century storage plan included two dams, one at Lake Albert with its regulator at the outlet of Lake Victoria and the second at the outlet of Lake Tana. Unfortunately, none of the projects included in that plan was implemented.

No of years	Period	Mean in billion m^3	Standard Deviation in billion m^3
28	1871–1898	109.775	13.26
61	1899–1959	83.752	12.33
89	1871–1959	91.939	17.48

Table 7-1: Mean annual discharge of the Nile

(Hurst et al. (1946; 1966).



Map 7-1: Map drawn by Hurst et al. for *The Nile Basin* (Hurst, et al., 1946)

(Note: the map is edited in red colour for clarification purposes)

Last but not least, the upstream countries aimed to use the Nile water to generate their requirements of hydroelectric power. The century storage plan also aimed to provide Uganda and Ethiopia with hydroelectric power generated from the damming of the Equatorial Lakes and Lake Tana, respectively. However, only the regulator dam of Lake Victoria was built, on the Owen Falls at the outlet of the lake. The Owen Falls Dam was completed in 1954 and was dedicated mainly to hydroelectric power generation with a capacity of 60 megawatts which increased gradually until it reached 150 megawatts in 1968 (Waterbury, 2002).

In summary, although the riparian countries had ambitious plans to alter the physical conditions of the Nile course to improve their benefits from it, their efforts yielded limited results. Downstream countries succeeded only in increasing the utilisable water of the Nile by 8.1 billion cubic metres, which was still below their water requirements. However, downstream countries failed to reach an agreement with the upstream countries to implement the century storage plan that aimed to stabilise the annual discharge of the Nile. Similarly, upstream countries had limited achievements in the field of hydropower generation. Only Uganda constructed the Owen Falls Dam to provide it with 150 megawatts of hydroelectric power. Therefore, the four studied countries had to continue their efforts to achieve the same three objectives during the post-colonial period.

1.2 Institutional Environment of the Nile Basin

This section briefly presents the main features of the institutional environment of the Nile at the beginning of the post-colonial period. It begins by mapping the state of informal institutions after the colonial period. Consequently, it explores the evolution of the formal institutions during the post-colonial period to trace its impact on the interactions among the riparian countries during the post-colonial period.

1.2.1 Informal Institutions

The informal institutions of the studied riparian countries did not experience significant changes during the colonial period. The most effective change was the full independence of the Ethiopian Church from the Coptic Church. Nevertheless, the influence of informal institutions on the inter-riparian strategic interactions became more evident during this period. The presence of Great Britain as a dominant power in the basin neutralised the role of informal institutions in the interactions among the riparian countries. However, with the gradual withdrawal of the colonial power from the region, the role of informal institutions began to materialise in the interactions among the riparian countries over the future project of Nile in the second phase of the colonial period.

The Ethiopian regime sparked the separation process in the middle of the 1950s. The revised Ethiopian Constitution in 1955 expanded the control of the Ethiopian emperor over the Ethiopian Church by defining him as the head of the Church and giving him the right to appoint all bishops including the Abuna himself. Consequently, the Ethiopian emperor sought the approval of the Coptic Church for his newly acquired rights through negotiations that continued for more than three years. Finally, an agreement was signed between the two churches to formalise this separation in June 1959 in Cairo. During this ceremony, the Egyptian Patriarch appointed for the last time the Ethiopian Abuna, giving him the full power of a head of an autocephalous church (Erlich, 2002). The ceremony marked not only the

disconnection between the two churches but also the end of the religious dependence of Ethiopia on Egypt. This development gave Ethiopia more freedom in its strategic interactions with Egypt.

These interactions among the riparian countries at the end of the colonial era revealed the resilience of informal institutions of the riparian countries. The brotherly informal institutions between Egypt and Sudan enabled them not only to overcome the technical differences between their interests but also to defeat the British attempts to break their historical bonds during the different Nile negotiations. In contrast, the conflict of informal institutions between Egypt and Ethiopia over the ownership of the Nile limited their potential for cooperation to maximise their benefit from the Nile water. This disequilibrium between the informal institutions of Nile ownership and the formal institutions that were established during the colonisation created a serious imbalance in the relations between Egypt and Ethiopia. This imbalance hindered the cooperation attempts during this period and challenged their future cooperation in this field. Finally, although the informal institutions between Egypt and Uganda were neutral during the interactions between the two countries, this period acted as an early formative period that demonstrated the fruits of cooperation between the two sides.

1.2.2 Formal Institutions

The international formal institutions that governed the Nile Basin witnessed significant change during the post-colonial period. These changes were the result of the development of international law during this period. Two major breakthroughs have occurred in the field of international law since the 1950s. The first was the adoption by the International Law Association (ILA)[5] of the Helsinki Rules on the Uses of the Waters of International Rivers in 1964. The second was the adoption of

[5] The ILA is an international non-governmental organisation that was founded in Brussels in 1873 as an institution devoted to the development of international law and international relations. It accepts lawyers and non-legal professionals who are interested in the field of international relations. Moreover, it also receives delegates from the professional bodies that are affected by international law. The ILA has contributed significantly to the evolution and improvement of international law (Malla, 2009). Like the IIL, this institution adopts resolutions and rules that have considerable authority and have been considered as established customary principles of international law (Salman, 2007).

the United Nations Convention on the Law of the Non-navigational Uses of International Watercourses in 1997. These two conventions were the result of extensive and continuous work of the ILA and the UN that extended over the second half of the twentieth century.

1.2.2.1 Helsinki Rules

The ILA began to tackle the field of international watercourses in the 1950s (Malla, 2009). However, contrary to the work of IIL, its work in the field of international watercourses law gradually adopted the principle of equitable utilisation of common water courses (Salman, 2007). Three resolutions represented the main pillars of the ILA approach to sharing and utilisation of watercourses: the Resolution of Dubrovnik, the Resolution of New York and the Helsinki Rules.

The first resolution of the ILA in the field of shared water courses was issued in 1956 and was titled the Resolution of Dubrovnik. This resolution included a statement of principles that should govern international rivers. This statement recognised the sovereign control of the riparian state over the international river within its own boundaries (FAO, 1998). However, the statement obliged the riparian state to exercise such control with due consideration for its consequences on other riparian states (FAO, 1998).

The ILA developed its approach further in its resolution on the use of the waters of international river that was adopted in New York in 1958. The Resolution of New York emphasised that each riparian state is entitled to a reasonable and equitable share in the beneficial uses of waters of the river basin (FAO, 1998). However, the resolution left the criteria that identify this reasonable and equitable share to be determined according to all the relevant factors of each particular case (FAO, 1998).

The Helsinki Rules adopted the doctrine of equitable utilisation in international water law (Spiegel, 2005). The principle of equitable utilisation was discussed thoroughly at the Tokyo meeting of the ILA in 1964 (Salman, 2007). Consequently, the ILA adopted the instrument known as the Helsinki Rules on the Uses of the Waters of International Rivers at its conference in Helsinki in 1966. The

Helsinki Rules identified a set of factors for determining the equitable share of each riparian state in the drainage basin of the watercourse. These factors include, but are not limited to:

(a) the geography of the basin, including in particular the extent of the drainage area in the territory of each basin State;
(b) the hydrology of the basin, including in particular the contribution of water by each basin State;
(c) the climate affecting the basin;
(d) the past utilization of the waters of the basin, including in particular existing utilization;
(e) the economic and social needs of each basin State;
(f) the population dependent on the waters of the basin in each basin State;
(g) the comparative costs of alternative means of satisfying the economic and social needs of each basin State;
(h) the availability of other resources;
(i) the avoidance of unnecessary waste in the utilization of waters of the basin;
(j) the practicability of compensation to one or more of the co-basin States as a means of adjusting conflicts among uses; and,
(k) the degree to which the needs of a basin State may be satisfied, without causing substantial injury to a co-basin State.

(FAO, 1998, pp. 293-294)

One important feature of the Helsinki Rules is that it included the obligation not to cause substantial injury or harm to another riparian state as one of the factors that determine the equitable use and not as a separate principle of the utilisation of the international rivers. Finally, it should be emphasised that, although the Helsinki Rules had no formal legally binding effect, it was considered as an important soft law source during the period from the 1960s to the 1990s (Malla, 2009).

2 Institutional Change: 1954–1997

At the beginning of this period, Ethiopia was the only country which had full independence. However, the other three countries gained their independence during this period. Egypt was the first to become independent in June 1954. Consequently, Sudan declared its independence from the Anglo-Egyptian rule in January 1956. Finally, Uganda gained its independence from British rule in 1962. The successive decolonisation of the Nile riparian countries marked the beginning of a new era in the Nile Basin in which the Nile riparian countries become the only actors in the Nile action situations. Although there was an initial wave of optimism among the riparian states about the potential of cooperation among them, it became clear over time that the cooperation among riparian states was more complicated than it was before the decolonisation.

This period can be divided into two phases. The first phase extended from the beginning of the decolonisation of the riparian countries in 1950s until the end of the 1990s. The main feature of this phase was that it was dominated by the bilateral interactions among the riparian countries. Nonetheless, the establishment of the Nile Basin initiative at the end of 1990s marked the beginning of a new phase in which the riparian states sought to establish a basin-wide mechanism of cooperation among themselves.

2.1 First Phase: Bilateral Strategic Interactions (1954–1984)

This phase witnessed three main action situations among the studied riparian countries. Egypt and Sudan were the actors in the first action situation that led to the signature of the treaty of 1959. The second action situation is composed of repeated interactions between Egypt and Ethiopia which took the same pattern without any fruitful results. The final action situation is an extended action situation in which Egypt and Uganda implicitly agreed on achieving a non-collective action result. These three action situations are analysed in the following sections, with more specific attention given to the demonstration of the role of informal

institutions in these situations.

2.1.1 Egypt–Sudan: Action Situation of 1959

2.1.1.1 Setting

The failure of the Egyptian attempts to reach an agreement with the upstream countries over the century storage project induced Egypt to begin to investigate new storage projects within its borders. In 1952, an Egyptian agronomist from Greek roots, presented a proposal for building a huge dam on the rocky area south of Aswan. This dam would have over-year storage capacity sufficient to guarantee a stable annual flow of the Nile within Egypt. The idea of this dam was to control the entire flow of the Nile within the Egyptian borders.

However, the establishment of such a huge dam within its border would practically permit Egypt to nationalise the Nile. Great Britain felt that its interests were threatened by this huge dam project for various reasons (Tvedt, 2004). First, it would replace the old century storage projects in the Equatorial Lakes and Lake Tana. This meant that the hydropower projects in the Equatorial Lakes that would benefit its Ugandan colony would not be carried out. Moreover, the British plans to secure the needed water for the agricultural sector through the Tana dam would be difficult to implement without the involvement of Egypt. Second, the British government believed that the construction of the dam would strengthen the Egyptian position in any future negotiations with upstream countries and Sudan, which was still under British colonial rule. Finally, the British experts predicted that the dam would flood a part of northern Sudan named Wadi Halfa, which would have negative consequences for the inhabitants of this region. Therefore, the British government attempted to use Sudanese side to stop the Egyptian project.

2.1.1.2 Actors

2.1.1.2.1 Sudan

Sudan witnessed two inter-related major changes during the 1950s. Firstly, it became a fully independent state in 1956. Second, Sudanese government started to develop its own plans to develop Sudanese agricultural sector. These two developments initiated a new phase the hydrological relations between Sudan and Egypt.

The contention between Egypt and Britain over the future status of Sudan led gradually to Sudanese independence from Anglo-Egyptian rule. This process of gradual independence began with the establishment of an Advisory Council in 1943 (Collins, 2008). The council consisted of 28 Sudanese members and the British Governor-General of Sudan. Although the council was merely a debating forum, composed of 18 members who were selected on tribal basis and 10 who were civil servants, it represented a first step on the road to the formation of Sudanese state. This step paved the way to ending the segregation policy of Southern Sudan in 1947 for the first time since this policy was adopted by the British government at the beginning of the twentieth century (Tvedt, 2004). This integration of southern Sudan was combined with the establishment of a legislative assembly for Sudan that represented the whole country and an executive council of which only half the members were Sudanese. Although Egypt attempted to resort to the international community to settle Sudan Question by referring it to the United Nations in 1947, British diplomacy succeeded to get the issue withdrawn by the UN Secretary-General with the question unresolved (Collins, 2008). This led Egypt to abrogate the Anglo-Egyptian Treaty of 1936 that included, among other things, the arrangement of the governance of Sudan. Although Egypt declared its sovereignty over Sudan in 1951, it granted it the right of self-administration in 1952 and the right of self-determination in a referendum that was supposed to be held after three years. This led to the formation of the first Sudanese government in 1954. Sudanese people and elite themselves were divided into two opposing parties: unionists and separatists. The contentions between the two parties and the British support for the separation

of Sudan to secure British interests in Sudan after the decolonisation of Egypt in 1954 led to a unilateral declaration of the legislative council of the independence of Sudan at the beginning of 1956, a few days before the referendum.

Although Sudan achieved its independence from Anglo-Egyptian rule in 1956, the relations between Egypt and Sudan remained strong. The unity with Sudan was always the objective of Egypt since the establishment of the Anglo-Egyptian rule over Sudan in 1899. This unity of the Nile valley found support in the historical brotherly informal institutions between the two nations. However, the United Kingdom formulated its strategy in the region with the control of the Suez Canal as its supreme objective. Therefore, it aimed to control Egypt through the control of its Nile water supply whose final gateway to Egypt was Sudan. Therefore the British strategy was formulated based on a belief that the power that held Sudan would hold Egypt at its mercy and through Egypt this power could dominate the Suez Canal (Tvedt, 2004). Thus, the British government was keen to keep the Egyptian co-rule over Sudan as nominal. The full independence of Egypt from Britain in 1956 induced the British government to support the separation of Sudan that was materialised at the beginning of 1956. However, Sudanese supporters of the unity between Egypt and Sudan maintained a strong position in Sudanese society and the political arena, represent by the Umma party which was one of the two major political parties after independence. This pro-unity party and its supporters were among the main forces that maintained the dynamism and the strength of the linkages between the countries after independence. These strong linkages were among the main determinants of the negotiations between Egypt and Sudan over the Nile water utilisation.

The negotiations between Sudanese authorities and the Egyptian government over the impact of the new Aswan High Dam started even before independence. In 1949, the government of Sudan claimed that it needed an additional 11 billion cubic metres to meets its future requirement of water (Collins, 1990). Moreover, in 1950 the British administration sponsored a survey of Sudan's potentially cultivable area whose conclusions recommended the cultivation of 2 million additional *feddans* (Yohannes, 2008). The cultivation of the new lands was

recommended to be carried out through the construction of a new medium dam of a capacity of 3 billion cubic metres on the Blue Nile at Roseires near the Ethiopian border (Yohannes, 2008). An Egyptian offer of mutual approval of the construction of the Egyptian and Sudanese dam was rejected by Sudanese government in 1954 (Tvedt, 2004). However, the negotiations become more serious after the declaration of independence in 1956. The belief of Sudanese elite that the development of the agricultural sector could be the pillar of the modernisation of the whole country brought the Nile water to the centre of the interests of successive Sudanese governments (Yohannes, 2008). Although Sudan changed government more than once during the negotiations until the military government took power in in 1958, their objectives in the negotiations remained the same. The first was to increase Sudanese share of the Nile water (Taha, 2010). The second was to get the Egyptian approval for the construction of the Roseires Dam (Taha, 2010).

2.1.1.2.2 Egypt

Egypt embarked on the Aswan High Dam project to overcome the growing internal challenges and to support its modernisation project. The increasing population growth and the plans for industrialisation obliged Egypt to attempt to increase its water supply and to seek innovative energy resources. The High Dam project represented a potential source for both stable water resources and hydropower supply. However, the huge size of the project and its trans-border consequences obliged Egypt to seek international finance and to negotiate a settlement with Sudan over utilisation of the Nile water.

The Egyptian strategy towards the Nile water was shaped by three main determinants. First, Egypt's growing population gradually put pressure on the agricultural sector to meet its nutritional needs. As indicated above, the population growth was reflected in the decline of the average share of individuals in the cropped agricultural lands. The cropped area per capita declined from 0.71 *feddan*s in 1897 to 0.48 *feddans* in 1947 (Waterbury, 1979). Therefore, the need to increase the cultivated area of Egypt became evident. Second, the Egyptian agricultural sector moved from subsistence to production for the world market (Waterbury, 1979).

Since the Egyptian economy at that time still relied mainly on the agriculture sector, the cost of the low-flood years became very detrimental to the economy. Therefore, the need to stabilise the annual water supply of the Nile became very urgent. Third, the country experienced a revolution in 1952 whose main project was the industrialisation of the economy. The industrial development increased the country's energy requirements.

The High Dam project represented a solution to this multi-faceted problem. With regard to water shortage, it was estimated that Egypt and Sudan used nearly 50 billion cubic metres of the Nile water while 34 billion cubic metres on average flowed to the Mediterranean Sea (Hurst, et al., 1966). The construction of the proposed dam at Aswan would allow Egypt to control the flow of Nile water to release timely water that could be utilised more efficiently in irrigating additional agricultural lands. It was estimated that the dam project would enable Egypt to increase its cultivated land from around 5.75 million *feddan*s to 7.1 million *feddan*s (Hurst, et al., 1966). Concerning the unpredictability of irrigation water resources, it was estimated that the High Dam could provide Egypt with a stable annual water supply of 70 billion cubic metres. Finally, the preliminary estimations of hydropower that could be generated annually by the power stations attached to the proposed dam were around 10 million kilowatts (Hurst, et al., 1966). However, the real design of the dam had an initial capacity of hydropower generation of only 720,000 kilowatts which could later be doubled (Tvedt, 2004).

Although one of the main advantages of the High Dam project was that the dam location was within the boundaries of Egypt, the Egyptian government had to reach a settlement with Sudan over the dam project. The High Dam was a huge project that included a reservoir of capacity of 155 billion cubic metres through an artificial storage lake that would extend for 500 kilometres. The cost of the project was estimated to be 1.2 billion dollars which would be partially financed by the International Bank for Reconstruction and Development (IBRD). Nevertheless, it was estimated that the project would displace 70,000 people, 50,000 of them living on Sudanese territory. Therefore, since the dam was expected to have negative consequences for the northern part of Sudan, the IBRD required Egypt to reach an

agreement with Sudan over the dam. The IBRD and the Western donors withdrew their offer of finance for the dam in 1956 in an incident that led to the nationalisation of the Suez Canal and the Suez War. Britain's attempts during the Suez War to mobilise the Nile riparian countries, including Sudan, against Egypt made the latter more determined to reach a settlement at least with Sudan over the dam and the Nile water sharing question. Although Egypt received a financial offer for the dam from the Soviet Union that permitted it to start the initial phase of the construction 1957, Egypt negotiated seriously for the Nile water sharing with Sudanese government after Sudan's independence in 1956.

2.1.1.3 Formal Analysis

2.1.1.3.1 Early Stages: Pragmatism

Negotiations started in the early 1950s while Sudan was still under Anglo-Egyptian rule. The timing of the beginning of the negotiations determined to a great extent the rules that governed the action situations. At the time the negotiations between Egypt, Britain and Sudanese elite over the future of Sudan were fierce. Therefore, each of the parties was playing the strategic game aggressively. Although Egypt sought unity with Sudan, it had a fear of granting exaggerated rights to Sudan that can be used against its interests in case of the independence of Sudan (Tvedt, 2004). Similarly, although Sudan was divided between pro-unity and the pro-independence factions, both of them attempted to gain the maximum concessions from Egypt in these negotiations (Tvedt, 2004). Sudanese elite in both political wings had personal interests in irrigated agriculture. Therefore, both attempted to secure the necessary water rights for the future development of the agricultural sector in Sudan. Moreover, the pro-unity faction had an additional motive, which was to prove their loyalty to their homeland. Moreover, Great Britain attempted to use its presence in Sudanese authorities to mobilise public opinion against the Egyptian plans. "There can be no doubts that the British government and British officials in Sudan exaggerated the water crisis there at that time" (Tvedt, 2004, p. 282). "Pamphlets on the water question, hostile to Egyptian interests, had been issued by the British officers in Sudan" (Tvedt, 2004, p. 292). This induced growing demands

in Sudan to review the treaty of 1929 and put pressure on Sudanese negotiators to achieve the best deal they could in their negotiations with the Egyptian delegation, setting aside the historical relations between the nations and the inherited brotherly informal institutions.

Therefore, the positions of the two actors were determined by the treaty of 1929. This treaty granted Egypt the position of the owner of the Nile, having veto rights on the construction of any irrigation projects on the Nile. The objective of Egypt in this negotiation was twofold: first, it aimed at gaining additional water supply, and secondly, it wanted to use the Nile water for hydropower generation. The same treaty granted Sudan, for the first time, the position of a full legal beneficiary of the Nile water. The objective of Sudan was mainly to gain additional water supply. Therefore, the potential for cooperation depended on the parties' ability to cooperate together to serve their common interest to overcome their competitive interests. Their common interest was to maximise the utilisation of the annual discharge of the Nile water, yet both countries competed over their share of the annual discharge of the Nile water.

The possible actions of the participants in this game were conditioned on their estimations of the actions of the other party. The first potential action for Egypt was allow a growth in the effective water share of Sudan either by approving the Roseires dam or by accepting an arrangement that permitted growth in Sudanese share of water in return for Sudanese approval of the high dam. The second available Egyptian action was to maintain the status quo that was established by the agreement of 1929. This option would leave the established historical rights untouched but Egypt would not gain any benefit in terms of water or hydropower. With regard to Sudan, the first potential action was to accept the construction of the high dam in order to gain Egyptian approval for increased water share for Sudan and Egyptian compensation for any negative consequences of the dam as well as Egyptian approval of the construction of the Roseires dam. The second available action would be to maintain the stagnated status quo. However, this option would limit Sudan's water supply to the existing share determined by the agreement of 1929. It might also have negative consequences for future projects in Sudan, such as

the Roseires dam, as the agreement of 1929 had given Egypt veto rights on any project constructed on the Nile.

Participant	Position	Possible actions
Egypt	The owner of the Nile whose objectives were: increased water utilisation; bigger water share; and hydroelectric power	Accept an arrangement permitting increase in Sudanese share of water
		Maintain the status quo of having de facto historical rights over the Nile
Sudan	Beneficiary of the Nile whose objective was increased water utilisation; bigger water share	Accept the construction of the High Dam
		Maintain the status quo that was established by the previous agreements

Table 7-2: Structure of action situation of 1959.

This was a game with one possible cooperative outcome. The cooperative outcome would have occurred if Egypt agreed to an increase in the water share of Sudan that would be acceptable to both parties, approved the construction of the Roseires dam and paid the required compensation for the negative consequences of the High Dam and Sudan in return accepted the construction of the High Dam. The second possible outcome would be the case of no action that would maintain the status quo for both participants in this situation. The two other options would entail one participant acknowledging the other participant's interests while the other does not react positively.

Formal analysis of the game will reveal the impact of the gap between the demands of both actors on the valuation of Egypt and Sudan of the net payoffs of the possible outcomes of the game. The valuation of each net payoff was determined by

the present value of the expected benefits costs of each outcome. Clearly, this valuation of the net payoff of each outcome determined the choice of strategies of each actor in the game.

With regard to Sudan, its pattern of valuation of the payoffs of outcomes can be deduced from the previous analysis. Sudan preferred the option of maintaining the status quo ($V_{SUD\text{-}sq}$) over accepting unilaterally the Egyptian rights ($V_{SUD\text{-}SUD}$). Therefore

$$V_{SUD\text{-}sq} > V_{SUD\text{-}SUD} \quad (7.1)$$

Similarly, the Egyptian government preferred the status quo ($V_{EG\text{-}sq}$) over unilateral approval of Sudanese demands. Egypt would not grant Sudan increased share of the Nile water without building the High Dam that would enhance the utilisation of Nile water and increase the Egyptian share of water ($V_{EG\text{-}EG}$).

$$V_{EG\text{-}sq} > V_{EG\text{-}EG} \quad (7.2)$$

However, both parties in this game preferred the status quo over the mutual acceptance of their demands. This was a consequence of the significant gap between the positions of the two countries in the negotiations. On one side, Sudanese negotiators vetoed the construction of the Egyptian High Dam in 1954. However, the government of Sudan offered to accept the construction of the High Dam on three conditions. The first was that the share of Sudan in the annual discharge of the Nile would have to be determined before the construction of the dam. Sudan government estimated that at least 5 million additional *feddans* could be cultivated (Tvedt, 2004). Therefore it demanded a share of 35 billion cubic metres out of the 84 billion cubic metres that was estimated as the average annual discharge of the Nile (Tvedt, 2004). This would leave Egypt with almost the same water share that it had without the construction of the dam. The second condition was to grant Sudan approval to construct any project that could enhance its utilisation of the Nile water. Finally, Sudanese government refused to bear any part of the losses caused by the negative consequences of the proposed dam. It demanded the Egyptian government to make the necessary arrangements for resettlement of the population of Wadi Halfa (Tvedt,

2004). On the other side, Egypt first offered to give its consent to the Roseires dam in exchange for Sudan's acceptance of the High Dam. However, Sudanese negotiators rejected the offer as they considered the Roseires dam as too modest to be compared to the High Dam. Consequently, Egypt proposed to subject the water-sharing to a criteria-based formula. The criteria included four determinants. First, the population of the two countries was the main determinant of this criteria. This determinant would give advantage to Egypt as the population of Sudan was one-quarter that of Egypt. The second determinant was the crop factor, which referred to the necessary amount of water to produce comparable crops in the two countries, taking into account the differences between them in rainfall. The third factor was referred to as the consumptive use factor, which describes the ideal amount of water necessary to produce the best possible crop. It was estimated that Egypt and Sudan had very similar crop and consumptive use factors. However, the fourth determinant, which was a gross factor based on the amount of water that was normally irrigated to a given area regardless of the size of the crop produced or the frequency of cultivation, gave another advantage to Egypt in the water-division criteria. Since Egypt cultivated its agricultural lands more extensively, it was estimated that the gross factor of Egypt was four times that of Sudan. Therefore, Egypt offered, based on this criteria, to increase the water share of Sudan to 8 billion cubic metres of the additional future water supply. This meant that the water share of Sudan would have increased to 12 billion cubic metres out of the expected average of 84 billion cubic metres after the building of the High Dam (Tvedt, 2004). Moreover, there was a belief among some circles of the Egyptian government that Sudan should assume, fully or partially, the costs of resettlement of the inhabitants of Wadi Halfa because Sudan would benefit also from the High Dam in terms of the quantity of water supply as well as its stability over years (Collins, 1990). This significant gap between the demands of the two parties led to the stagnation of the negotiations.

With regard to Egypt, if it accepted Sudanese demands, it would accept the increase of Sudanese share of water to 35 billion, gaining only one additional billion cubic metres of water and the generated hydroelectric power. However, in return, it would have to assume the costs of building the High Dam and the related

compensations (C). Furthermore, it would have sacrificed its veto rights (V) granted to it by the treaty of 1929 without any comparable return. Therefore, Egypt refused to approve all the demands of Sudan in return for the construction of the High Dam ($V_{EG\text{-}35CV}$). However, it was willing to accept a Sudanese share of 12 billion cubic metres and to approve the Roseires dam, leaving future Sudanese projects to be approved case by case ($V_{EG\text{-}12R}$). This meant that:

$$V_{EG\text{-}12R} > V_{EG\text{-}35CV} \tag{7.3}$$

On the other hand, if Sudan accepted the Egyptian offer, it would have committed itself legally to limit its benefit from the High Dam, its future share of the Nile water, to 12 billion cubic metres which was, according to Sudanese government estimates, below the potential of Sudanese agricultural sector. This would have meant that Sudan would have gained an additional water share of 8 billion cubic metres as a benefit from the High Dam while being responsible to compensate Sudanese people displaced because of the dam. Therefore, Sudan demanded a water share of 35 billion and Egyptian compensation (C) as well as Egypt's abdication of its veto rights on the irrigation projects on the Nile (F).

$$V_{SUD\text{-}35CF} > V_{SUD\text{-}12R} \tag{7.4}$$

This game could be represented as follows in Table 7-3:

		Egypt: Accept	Egypt: Reject
Sudan	Accept	$V_{SUD\text{-}12R}$, $V_{EG\text{-}49C}$	$V_{SUD\text{-}SUD}$, $V_{EG\text{-}72VR}$
	Reject	$V_{SUD\text{-}35CF}$, $V_{EG\text{-}EG}$	$V_{SUD\text{-}sq}$, $V_{EG\text{-}sq}$ ★

Table 7-3: Matrix of action situation of 1959 - Equilibrium.

As depicted above, this is a game of prisoners' dilemma, where the two actors reached a Nash equilibrium which was suboptimal from the social point of view. Both countries preferred not to cooperate and the negotiations stagnated in 1955. However, two developments occurred in 1956 that changed the settings of game. The first was the declaration of the independence of Sudan from Anglo-Egyptian rule. Although this independence was regarded as an additional obstacle to the negotiations between Egypt and Sudan, the post-independence regimes addressed the negotiations in a much more constructive way.

The independence of Sudan put pressure on the two regimes to prove that this independence did not affect the historical relations between the two nations. More specifically, independence made the cost of failure of the negotiations too high to be assumed by either of the two regimes. On the Egyptian side, "internal domestic enthusiasm for the dam was so great that to hold up its construction because of failure to reach a settlement with their Sudanese brothers was a situation which would never have been understood by the Egyptian populace" (Collins, 1990, p. 268). Although Egypt received a financial offer from the Soviet Union that was not conditional on Sudanese approval, it was difficult for the Egyptian regime to justify ignoring the needs of Sudanese brothers to the Egyptian population. On Sudanese side, the failure of the tripartite attack on Egypt in the Suez War made Egypt a hero for all Arab nations. Therefore, it became risky for the successive Sudanese regimes to antagonise Egypt as this would negatively affect domestic popular support, especially from those who used to be pro-unity with Egypt as they considered Egyptians and Sudanese as brothers separated only by artificial political borders. Moreover, in 1958, a military regime came into power whose main support was the pro-unity Sudanese. Therefore, this regime was keen from its early days in power to emphasise its desire and readiness to settle the water issue to secure internal support from the pro-Egypt groups and external support from Egypt itself. This new political climate led to the reintegration of the informal institution of the *historical brotherhood between Egypt and Sudan* as one of the main factors in the net benefit calculations of both parties in this action situation. This meant that the actions and the results of the interaction of the two players should reflect brotherly informal

institutions inherited between the nations; otherwise, the failure to meet the expectations of the two nations might have a negative impact on the internal stability of both countries. In other words, the maintenance of the internal stability became one of determinates of the calculations of the benefits of the regimes of both countries in this action situation (Diagram 7-2).

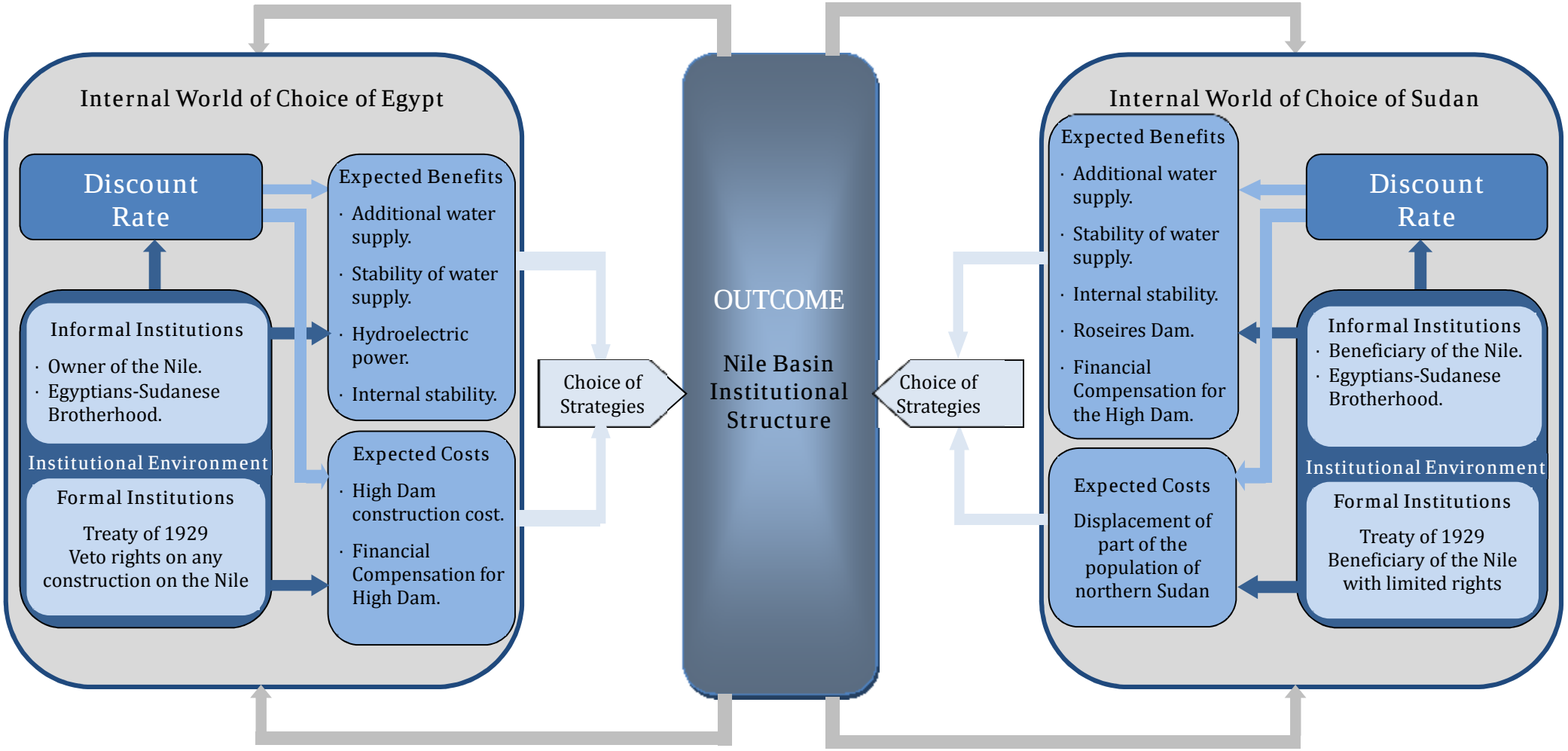


Diagram7-2: Strategic institutional change: Egypt–Ethiopia 1950.

The new context of the action situation induced the two actors to move towards a compromise that could meet an acceptable part of their requirements. Sudan compromised by recognising the historical rights of Egypt over the Nile water and the veto rights which were established formally in 1929. In return, Egypt agreed to approve a share of the additional water provided by the High Dam that would be sufficient to meet the needs of Sudan. Therefore, Egypt agreed to limit its share of the additional water provided by the construction of the High Dam to less than one-third of this additional water. More specifically, Egypt increased its established share of the Nile water, which was 48 billion cubic metres, by 7.5 billion cubic metres to 55.5 billion cubic metres. On the other hand, Sudan would gain the rest of the additional water, which amounted to 14.5 billion cubic metres. Therefore, Sudanese share of the Nile water would rise to 18.5 billion cubic metres. In addition, Egypt would approve construction of the Roseires Dam and pay all the compensation for the displacement of people in northern Sudan. In this way, the action situation took the form of a coordination game which could be represented as in Table 7-4:

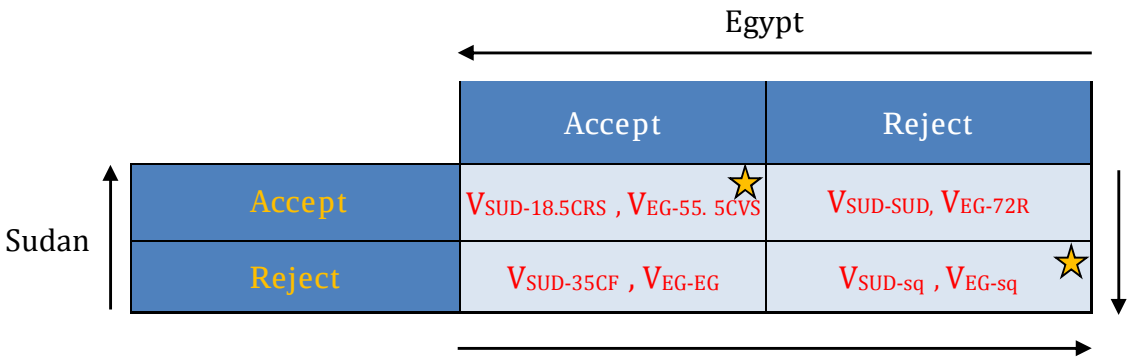


Table 7-4: Matrix of action situation of 1959 – possible equilibrium.

As indicated by the diagram, both countries preferred the cooperative settlement over the non-cooperative one. Egypt agreed to limit its share of additional water not only in return for recognition of its veto rights and for hydroelectric power but also to maintain its internal stability (S) which would be strengthened by the achievement of such agreement with Sudan. Egypt preferred this settlement over

unilaterally building the dam and ignoring Sudanese needs, which may induce an Egyptian-Sudanese conflict that might threaten the internal stability of the country.

$$V_{EG\text{-}55.5CVS} > V_{EG\text{-}72R} \quad (7.5)$$

Similarly, Sudanese government preferred to recognise the historical and established rights of Egypt over the Nile water in return for not only its technical demands but also the maintenance of brotherly and cordially relations with Egypt which had a positive impact on the social cohesion of Sudanese society. Sudanese reports that analysed the negotiations between Egypt and Sudan emphasised that "any attempt by the independent Sudan to tamper with the established Egyptian rights on Nile sharing was a matter that to the Egyptians was so sensitive that it would mean a first class row between the two countries" (Tvedt, 2004, p. 281). Clearly, a country that had a significant part of its population supporting the unity, or at least special relationship, with Egypt would prefer to compromise on these negotiations over freeriding on the Egyptian water share.

$$V_{SUD\text{-}18.5CRS} > V_{SUD\text{-}35CF} \quad (7.6)$$

This compromise was formalised in an agreement signed between Egypt and Sudan in 1959 to settle and formalise the equilibrium of the game on its cooperative outcome ($V_{SUD\text{-}18.5CRS}$, $V_{EG\text{-}55.5CVS}$).

2.1.1.3.2 Treaty

The agreement between Egypt and Sudan was formalised in an agreement titled the agreement between the United Arab Republic[6] and the Republic of Sudan for the full utilisation of the Nile waters, signed on 8 November 1959 at Cairo. The treaty dealt with the allocation of the shares of Egypt and Sudan of the additional utilisable water provided by the High Dam. It also organised the pattern of allocation of water as a result of any future projects or agreements with the other riparian countries. Moreover, it included the obligation of Egypt to pay compensation for the

[6] Egypt was formally known as the United Arab Republic after the political unification with Syria in 1958. This political unity came to an end in 1961 as a result of a military coup in Syria in 1961.

displaced people in Sudan as a result of the High Dam project. Finally, the agreement established a permanent joint committee between the countries to study and coordinate future plans for conservation and control of the Nile.

This agreement estimated the mean annual discharge of the Nile over the measured annual flows over the period 1900-1959 to be 84 billion cubic metres. Moreover, it was estimated that loss as a result of evaporation in the High Dam reservoir would be 10 billion cubic metres per annum. Egypt was granted an additional share of water of 7.5 billion over its established rights under the treaty of 1929. Theretofore, its total share reached 55.5 billion cubic metres. Sudan was granted an additional share of 14.5 billion cubic metres to raise its total share to 18.5 billion. In this way the total Egyptian share declined from 92.4 % of the mean annual discharge of the Nile in the treaty of 1929 to around 75% of the mean annual discharge of the Nile. Sudanese share increased from around 7.6% of the annual mean discharge to around 25%.

Moreover, the agreement regulated the allocation and the benefits of any future project or agreement with upstream countries. It stipulated that the costs of any water conservation project would be divided equally between Egypt and Sudan. Similarly, the benefits in terms of annual water supply would be shared equally between the two countries. Finally, it obliged the two countries to assume equally any reduction in the water share as a result of allocation of water share to another riparian country.

Finally, there are some important points that are worth being emphasised about this agreement. First, although the final Nile regime developed by this agreement adopted the principle of established right, during the negotiations Egypt offered a formula of allocation that could be a form of equitable utilisation of water when it proposed using the population and current usage as the basis of allocation. Second, the agreement did not take into consideration the natural flow of the river to the Mediterranean Sea, which is estimated to be around 10 billion cubic metres deducted in practice from the Egyptian share as Sudan receives its share before the flow of the river to the Egyptian territories. Another important point was that the

agreement referred to the full utilisation of the Nile water although only Egypt and Sudan were involved in the negotiations and the signature of this agreement. This fact had important consequences for the interactions between Egypt and Sudan and the other riparian countries in the following years.

2.1.2 Ethiopia–Egypt: Repeated Chicken Game

2.1.2.1 Setting

Since the Nile water negotiation that Egypt started in the 1950s was induced by the High Dam project, Egypt limited the negotiations only to Sudan. The Egyptian argument for that was that Sudan was the only country that was at risk of having parts of its territories flooded by the dam. However, since the other riparian countries had interests in these negotiations, Ethiopia attempted to put pressure on Egypt to take Ethiopian interests into consideration in these negotiations.

Ethiopia had always adopted the Harmon doctrine of absolute sovereignty. The Ethiopian negotiation strategy was to establish a strong position that could enable it to demand monetary payments for water from downstream countries (Tvedt, 2004). This historical Ethiopian position encouraged Britain to try to bring Ethiopia into the Nile water negotiations between Egypt and Sudan in order to put pressure on Egypt (Tvedt, 2004).

2.1.2.2 Formal Analysis

The positions of Egypt and Ethiopia in this were similar to their previous game on the Lake Tana reservoir. The Egyptian position was shaped by the historical informal institution of the Egyptian ownership of the Nile that was supported by the treaty of 1902. Since the Ethiopian government repeatedly emphasised its repudiation of 1902, the Ethiopian position also relied on the informal institution of its ownership of the Blue Nile.

Similar to the previous Ethiopian-Egyptian strategic game, this game witnessed a conflict of positions between the two actors that was reflected in their strategic choices. With regard to Egypt, its first option was to build the High Dam upon the conclusion of its limited negotiations with Sudan, ignoring the claimed Ethiopian rights. The second Egyptian option was to include Ethiopia in the negotiations either via a notification of the Egyptian intentions of building the dam

or through a direct call to the negotiations. On the other side, the first Ethiopian action was to launch an attack on Egypt to halt its project until it reached a settlement with Ethiopia. This attack could have been either a diplomatic one or operational by establishing projects on the Nile that would affect the Egyptian water supply and force Egypt to initiate talks with Egypt. The second option was to avoid confrontation with Egypt.

Participant	Position	Possible actions
Egypt	Owner of the Nile	Construction of High Dam
		Negotiations with Ethiopia
Ethiopia	Owner of the Blue Nile	Diplomatic or field operations
		Maintain the status quo

Table 7-5: Structure of repeated chicken game between Egypt and Ethiopia.

In such confrontational games, the strategy is chosen by the participants according not only to their valuation of the benefits of the payoff of each outcome but also on their chances to get this outcome. Therefore, the use of mixed strategies based on the expected payoff of each outcome gives a better representation of the game. From the general context of this multi-player strategic interaction and the specific setting of this action situation, it can be deduced that Egypt preferred to ignore the upstream countries and limit the negotiations to Sudan in order to reach an agreement more easily as a basis for building the High Dam ($V_{EG\text{-}HD}$) rather than the inclusion of Ethiopia in the negotiations before building the dam ($V_{EG\text{-}NEG}$). On the other hand, Ethiopia might have preferred to force Egypt to involve itself in the pre-dam negotiation ($V_{ETH\text{-}NEG}$) rather than keeping silent to avoid conflict with Egypt ($V_{ETH\text{-}ATT}$). This can be represented formally as in Table 7-6:

$$V_{EG\text{-}HD} > V_{EG\text{-}NEG} \quad (7.7)$$

$$V_{ETH\text{-}ATT} > V_{ETH\text{-}S} \quad (7.8)$$

		Ethiopia	
		Attack	Avoid Conflict
Egypt	High Dam	W(EG, C), W(ETH, C)	V_{EG-HD} , V_{ETH-S}
	Negotiations	V_{EG-NEG} , $V_{ETH-ATT}$	V_{EG-NEG} , V_{ETH-S}

Table 7-6: Matrix of repeated chicken game between Egypt and Ethiopia.

The payoffs in case of confrontation need to be calculated since they depend on the different possibilities of the results of this confrontation. Assuming that any Ethiopian movement had a cost (C) assumed by Ethiopia and a damage (D) that would have been assumed by the loser in case it led to a confrontation.

The payoff to Egypt in case of confrontation with Ethiopia would have been:

$$W(EG, C) = P_{EG} * V_{EG-HD} + (1-P_{EG}) * (-D_{EG}) \quad (7.9)$$

Where:

P_{EG} was the probability that Egypt won the confrontation.

V_{EG-HD} was the valuation of Egypt for the benefits of the High Dam.

D_{EG} was the damage that Egypt would suffer in case of losing the confrontation

Similarly, the payoff to Ethiopia in case of confrontation with Egypt would have been:

$$W(ETH, C) = (1-P_{EG}) * V_{ETH-ATT} + (-C) + (P_{EG}) * (-D_{ETH}) \quad (7.10)$$

Where:

$V_{ETH\text{-}ATT}$ was the valuation of Ethiopia for the benefits that it could have obtained from the negotiations with Egypt.

D_{ETH} was the damage that Ethiopia would have assumed in case of losing the confrontation

Since the value of all above parameters depended on the type of the Ethiopian strategic actions, whether by diplomacy, infrastructure project on the Nile or even military attack. Ethiopia decided to make a strategic move to signal its commitment to put pressure on Egypt to involve it in the pre-dam negotiations.

The first strategic move from Ethiopia was diplomatic. Therefore, only a month after the independence of Sudan, on 6 February 1956 the Ethiopian government declared in its official newspaper that Ethiopia would reserve its right to utilise the Nile waters emerging from its territories (Collins, 1990). Ethiopia followed this declaration by sending an official note to the diplomatic missions in Cairo emphasising that it reserved the right to use the Nile water sources in its land to the benefits to the Ethiopian people (Collins, 1990). The British government encouraged Ethiopia to register an official claim to an undefined share of Nile water. There was, however, one major difference between the British and the Ethiopian governments. While Ethiopia wanted to repudiate the treaty of 1902 based on a claim that the Italian occupation in 1938 and the British acceptance of it made the treaty invalid, Great Britain was opposed to this Ethiopia intent as the British government wanted to maintain the treaty as a card that could be used to support Sudan in the future. Britain emphasised that the Nile-related Article 3 was a part of the treaty of 1902, which was a boundary treaty that could not be abrogated by the occupation of Ethiopia (Tvedt, 2004). Therefore, it informed the Ethiopian government that it had no right to repudiate the treaty. This meant that the chances of Ethiopia winning the diplomatic confrontation with Egypt became very low. In other words, the probability that Egypt would win the game became very close to one. Assuming that the cost of diplomatic action is close to zero, this confrontational outcome game can be represented formally as follows:

Since $P_{EG} \simeq 1$

Then

$$W(EG, C) = V_{EG\text{-}HD} \quad (7.11)$$

$$W(ETH, C) = -D_{ETH} \quad (7.12)$$

Clearly the damage (D_{ETH}) that Ethiopia would have assumed would be political and legal damage. Such diplomatic confrontation if it happened would have given Egypt a legal confirmation of its veto rights on the Blue Nile as well as a political precedent that could be repeated in the future. Clearly, Ethiopia preferred to freeze its diplomatic actions and keep silent to avoid diplomatic conflict with Egypt ($V_{ETH\text{-}S}$) rather than assuming the costs of losing such a confrontation ($-D_{ETH}$). Therefore, the game became a typical chicken game where Ethiopia chickened out while Egypt went straight on to achieve its objective. The game took the form as shown in Table 7-7:

Egypt \ Ethiopia	Attack	Avoid Conflict
High Dam	$V_{EG\text{-}HD}$, $-D_{ETH}$	$V_{EG\text{-}HD}$, $V_{ETH\text{-}S}$ ★
Negotiations	$V_{EG\text{-}NEG}$, $V_{ETH\text{-}ATT}$	$V_{EG\text{-}NEG}$, $V_{ETH\text{-}S}$

Table 7-7: Matrix of repeated chicken game between Egypt and Ethiopia - Equilibrium.

However, Ethiopia made another attempt to change the path of the game. Ethiopia attempted to threaten Egypt with construction of a project on the Blue Nile that could affect the water supply of Egypt. Ethiopia knew that such a threat, if credible, could change the whole game. In 1958 the Ethiopian government

mandated the Bureau of Reclamation of the United States Department of the Interior to carry out a survey of both the Blue Nile and the Tekeze basins in order to assess the potential for development of water resources in Ethiopia (Waterbury, 2002). Collins evaluated the potential impact of this move accurately when he commented on it by stating that "Such a prospect, no matter how remote, could not but rekindle ancient Egyptian fears of Ethiopian control of the life-giving water" (Collins, 1990, p. 279). The study was completed in 1964, identifying 26 sites for water development projects on both rivers that could abstract over 4 billion cubic metres of water from the Nile annually (Waterbury, 2002). The study proposed four main dams on the Blue Nile stream coming from Lake Tana at Maradobi, Mabil, and Mendala as well as on the border between Ethiopia and Sudan. The total storage of the four dams would be 51 billion cubic metres, which is equal to the mean annual discharge of the Blue Nile (Collins, 1990). The total hydroelectric power capacity of these proposed dams was estimated to be three times of the Aswan High Dam (Collins, 1990). The total quantity of the Blue Nile would be reduced by 8.5%. The amount of Ethiopian lands to be irrigated by the dam would be 17% of the total Egyptian agricultural lands and would deduct around 6 billion cubic metres of the Blue Nile water (Collins, 1990). Another 29 dams and hydroelectric power plants were proposed in the Blue Nile Basin (Collins, 1990, p. 280). However, although the results of this study revealed the great potential of the water storage and hydroelectric power generation in Ethiopia, it made the Ethiopian threat incredible. Ethiopia had neither the capital nor the administrative capacity to carry out the projects proposed by the American study (Collins, 1990). Therefore Egypt ignored the Ethiopian threat and continued its High Dam project without any consultation or even notification to Ethiopia. The Egyptian assessment of the Ethiopian threat at that time was right, as Ethiopia constructed only one regulating dam out of the 29 projects, the Finchaa reservoir, close to the outlet of Lake Tana. The work on this reservoir started in 1968 and the scheme was inaugurated in 1973 (Waterbury, 2002).

Therefore, Ethiopia had to chicken out again at that time from the game. However, it registered its rejection of the agreement of 1959 between Egypt and Sudan, considering it as binding only on Egypt and Sudan and not on any other

riparian country (Waterbury, 2002). However, it did not raise its objection to the agreement of 1959 with the international community (Waterbury, 2002).

This chicken game was repeated on a smaller scale during the following period as both countries insisted on proceeding unilaterally with their Nile water development projects. Although Ethiopia presented a country paper to the UN Water Conference at Mar del Plata in Argentina in 1977 that called for cooperation between riparian countries, it reserved its right to proceed unilaterally with projects included in the paper (Waterbury, 2002). Egypt then initiated a project in 1979 to establish a canal passing under the Suez Canal to provide Sinai with fresh water. As a reaction, Ethiopia filed an official complaint with the Organisation of African Unity at its 1980 summit in Lagos, charging Egypt with planning to divert the Nile water without any agreement with the other riparian countries, which is considered to be illegal. Moreover, Ethiopia denounced the project as a unilateral action and an extra-basin water transfer and threatened to construct a dam on the Blue Nile (Waterbury, 2002). Egypt emphasised that it would transfer only recycled water to Sinai for irrigation. Furthermore, it indicated that downstream riparian countries had no obligation to notify upstream countries unless the works were to result in flooding a portion of upstream riparian territories, as happened with Sudan in the construction of the High Dam. However, Ethiopia attempted to threaten Egypt by hinting that it planned to construct the Ethiopian-Sudanese Border dam on the Blue Nile. Nevertheless, Egypt replied with a counter threat that was very firm by threatening to go to war if Ethiopia caused any harm to the water supply of Egypt or Sudan (Waterbury, 2002). “The Egyptians have historically and deeply feared this threat to their survival, and such an action would be a tantamount to an act of war” (Collins, 1990, p. 283). Therefore, Ethiopia took the Egyptian threat seriously, considering it a credible threat. Consequently, Ethiopia had to chicken out again allowing Egypt to carry out its project.

In the middle of the 1990s, Ethiopia initiated another chicken game with Egypt. Ethiopia declared in 1994 a plan to build 500 micro-dams over the next decade in Tigray province (Waterbury & Whittington, 1998). These dams were estimated to collect up to 5 billion cubic metres of water in the Ethiopian lands,

resulting in a reduction of approximately 4 billion cubic metres in the water supply to Egypt (Waterbury & Whittington, 1998). Ethiopia chose this project carefully to avoid any Egyptian pressure or threat. There were two main advantages of these micro-dam projects. Firstly, they did not require international financing. Secondly, the micro-dam projects lessened the risk of Egyptian military intervention as Egypt would need to occupy Ethiopia to attack this large number of micro-dams. Therefore Egyptian military intervention became an incredible threat (Waterbury & Whittington, 1998).

Another important example of the chicken games between Egypt and Ethiopia was the Egyptian New Valley project. Egypt declared in 1997 plans for a project to transfer from 5 to 10 billion cubic metres of water per year from the reservoir of the Aswan High Dam through a new canal to new land reclamation projects in the Western Desert of Egypt (Waterbury & Whittington, 1998). Ethiopia protested in a letter sent from its Foreign Minister to the Egyptian Foreign Minister. Ethiopia also sent copies of this letter to the President of the World Bank, the Secretary General of the United Nations and the Secretary General of the Organisation of African Unity. The Ethiopian protest was based on three arguments. First, if there is a surplus of water over the Egyptian uses, it should be directed to respond to the upstream countries' needs not to new projects. Second, Ethiopia considered such projects as a way to create the basis for asserting new acquired rights to be used later as "current uses" in any negotiations. Last, Ethiopia emphasised that unilateralism in a river basin should be condemned in any context (Waterbury, 2002). However, Ethiopia did not escalate its protest and chickened out again, waiting for a chance to reverse the chicken game.[7]

[7] It worth noting that Ethiopia waited until 2011 to reverse this chicken game by carrying out its threat to establish a modified version of the Ethiopian-Sudanese Border Dam on the Blue Nile, which will not be analysed in this study as its out of the study period. The new dam, which is under construction, is named "The Renaissance Dam".

2.1.3 Uganda–Egypt: Collective Inaction

2.1.3.1 Setting

This action situation resumes the pattern of interactions between Egypt and Uganda after their independence. Although Egypt and Uganda had successfully resolved their previous interaction on the Owen Falls Dam in 1949, Great Britain attempted to use Uganda and the other equatorial riparian countries to put pressure on Egypt during the negotiations that led to the agreement of 1959 with Sudan. However, the two negotiating countries, Egypt and Sudan, maintained the bilateral character of the negotiations.

Subsequently, the equatorial upstream countries of the Nile Basin gained their independence in the early years of 1960s. Upon their independence, Kenya and Tanzania repudiated the treaty of 1929. Thus, Uganda faced the challenge of choosing between repudiation of the treaties that regulated the Nile-related relationship with Egypt, the treaties of 1929 and 1949, or renewal of its commitment to these treaties.

Great Britain preferred the Equatorial Nile project over the High Dam project because it believed that such a huge-storage dam would make Egypt more independent and dominant in the Nile Basin. To the contrary, the equatorial Nile project would make it more dependent on the other countries (Tvedt, 2004). Moreover, the British administrators of the East African colonies, including the government of Uganda, were unsatisfied with the legal framework governing the Nile Basin (Tvedt, 2004). Therefore, Britain attempted to bring the authorities of the East African territories to the negotiations between Egypt and Sudan in the second half of the 1950s. It hoped that the pressure of upstream countries in the negotiations would lead Egypt at the end of the day to give up the project (Tvedt, 2004).

In this context, the British Ambassador to Cairo informed the Egyptian government in an official note in November 1955 that Uganda, Kenya and

Tanganyika needed an additional share of water to meet their irrigation needs (Tvedt, 2004). Moreover, the British government threatened to use the Owen Falls Dam to turn off the Nile tap to Egypt. However, when the British administrators studied the impact of reducing the water flow from the Owen Falls Dam in Uganda, they found that the time lag between the reduction and its impact on Egypt would take at least four months to start affecting Egypt and its full impact would not be felt before 16 months (Tvedt, 2004). Moreover, they realised that the Egyptian engineers resident at the dam site would inform their government once the outflow of the dam changed, which would give the Egyptian government sufficient opportunity to react a long time before the impact of such a reduction was felt in Egypt (Tvedt, 2004).

Tanganyika was the first of the East African countries to achieve its independence in 1961. In 1962, it invoked what has become known as the Nyerere doctrine according to which, since former colonies did not participate in the formulation and the conclusion of the treaties signed during colonial period, they must not to be assumed to automatically succeed to these treaties (Collins, 1990). Consequently, the government of Tanganyika sent formal notes to the British, Egyptian and Sudanese government to inform them that the treaty of 1929 was not binding on the government of Tanganyika (Collins, 1990). Similarly, Kenya which received its independence in 1963 also invoked the Nyerere doctrine to repudiate the treaty of 1929 (Collins, 1990). However, Although Uganda became independent in 1962, its strategic choice in this regard was more complicated than those of Kenya and Tanganyika.

2.1.3.2 Formal Analysis

This game had the potential for cooperation as the countries did not have conflictive positions or objectives. However, the risks associated with the cooperation attempt and the benefits that Uganda and Egypt gained from the agreements of 1949 and 1959 respectively made the status quo more attractive than the cooperative option. Therefore, the possibility of cooperation diminished as both actors valued the status quo higher than the cooperative outcome.

Egypt maintained its traditional position of being the owner of the Nile. However, the High Dam project secured the additional water it aimed for during the first half of the twentieth century. Thus, it lost its interest in the development of the Equatorial Nile project at that time. Egypt became more interested in securing its new rights acquired by the agreement of 1959. This can be achieved either by launching a new round of negotiations with upstream countries or by maintaining the status quo by its political and diplomatic power in the region.

Uganda has a dual position in the Nile Basin as its geographical position makes it an upstream country and downstream country at the same time (Mulira, 2010). It is an upstream country vis-à-vis Sudan and Egypt. Uganda is a water-abundant country that has relied traditionally on rain-fed agriculture (Yohannes, 2008). Therefore, Uganda's needs of water for irrigation purposes have been limited. However, its rapid population growth might force it to resort to the Nile water to meet the future food supplies of its population (Yohannes, 2008). Therefore, it had difficulty affirming its recognition of the acquired rights of Egypt stated on the treaty of 1929. Uganda is at the same time a downstream country in Lake Victoria as it receives nearly two-thirds of its annual waters from outside its borders.

Therefore, Uganda's position as a downstream country coincides in many respects with that of Egypt and Sudan vis-à-vis the upstream countries in Lake Victoria such as Kenya, Rwanda and Burundi. More specifically, Uganda has been interested mainly in the utilisation of the Nile water for hydropower generation for its socio-economic development (Mulira, 2010). Therefore, its main interest has been guaranteeing an uninterrupted flow of water to secure the operation of the Owen Falls Dam. Since this uninterrupted flow also guarantees the acquired shares of Egypt and Sudan, Uganda's legal interests have coincided with Egypt and Sudan (Mulira, 2010). This dual position of Uganda has obliged it to be very cautious in its actions in the Nile Basin strategic interactions. Uganda had the option of repudiating the treaties of 1929 and 1949, calling for negotiations to reach a new binding agreement. The other option was to maintain the status quo that was regulated by these existing treaties.

Participant	Position	Possible actions
Egypt	Owner of the Nile	Repudiation of existing treaties & negotiation to get Uganda's post-dependence-recognition of Egypt's rights
		Maintaining the status quo
Ethiopia	Upstream and Downstream beneficiary of hydropower	Repudiation of existing treaties & negotiations to reach a new agreement with Egypt
		Maintaining the status quo

Table 7-8: Structure of collective inaction game between Egypt and Uganda.

This game had four possible outcomes: collective action, collective inaction and two free-riding outcomes. The collective outcome involves the concurrent commitment of both actors to engage in negotiations leading to a new binding agreement for both of them. Collective inaction would result from the preference of the two actors to maintain the status quo. The two free-riding dominated outcomes would involve one of the two participants free-riding on the cooperative behaviour of the other.

On the Ugandan side, the Ugandan government would prefer the option of maintaining the status quo ($V_{UG\text{-}sq}$) over unilaterally renewing its recognition of the Egyptian water rights ($V_{UG\text{-}UG}$).

$$V_{UG\text{-}sq} > V_{UG\text{-}UG} \tag{7.13}$$

Similarly, Egypt would prefer the status quo ($V_{EG\text{-}sq}$) over sacrificing unilaterally its rights acquired by the existing treaties ($V_{EG\text{-}EG}$).

$$V_{EG\text{-}sq} > V_{EG\text{-}EG} \tag{7.14}$$

However, both parties in this game preferred the status quo over the cooperative outcome. The motive for such a preference was not related to the direct outcome of the cooperative option, but to the potential indirect consequences of that outcome. The cooperative outcome would have entailed a mutual repudiation of existing treaties and launching a new round of negotiations that had good potential of success. However, this cooperative outcome would have induced indirectly similar calls from the other upstream countries for negotiations to reach new Nile water utilisation agreements.

On the Egyptian side, although Egypt knew that there was a strong possibility of reaching an agreement with Uganda that would maintain the Egyptian right, or at least the majority of it, because the Uganda interest was focused on the hydropower that could be generated from the Nile, it realised that the acceptance of such negotiations would encourage the rest of the upstream countries to ask for the same treatment. Since such negotiations with the other riparian countries might have led to the erosion of a significant share of Egyptian rights, Egypt preferred the status quo ($V_{EG\text{-}sq}$) over the mutually cooperative option ($V_{EG\text{-}mc}$).

$$V_{EG\text{-}sq} > V_{EG\text{-}mc} \tag{7.15}$$

Similarly, Uganda realised that the negative consequences of the negotiations of new agreements might outweigh their positive outcomes. Although the new agreement might have given Uganda a slight increase in its water share, this would encourage the other equatorial upstream countries to call for an increase in their water shares. If these countries succeeded in increasing their shares, the water flow to Egypt would have to decrease, leading to a decline in the hydropower that Uganda could generate from the Nile water. Since Uganda's main interest was hydropower generation and not irrigation water, it preferred to maintain the status quo ($V_{UG\text{-}sq}$) over the cooperative option ($V_{UG\text{-}mc}$).

$$V_{UG\text{-}sq} > V_{UG\text{-}mc} \tag{7.16}$$

This game can be represented as in Table 7-9:

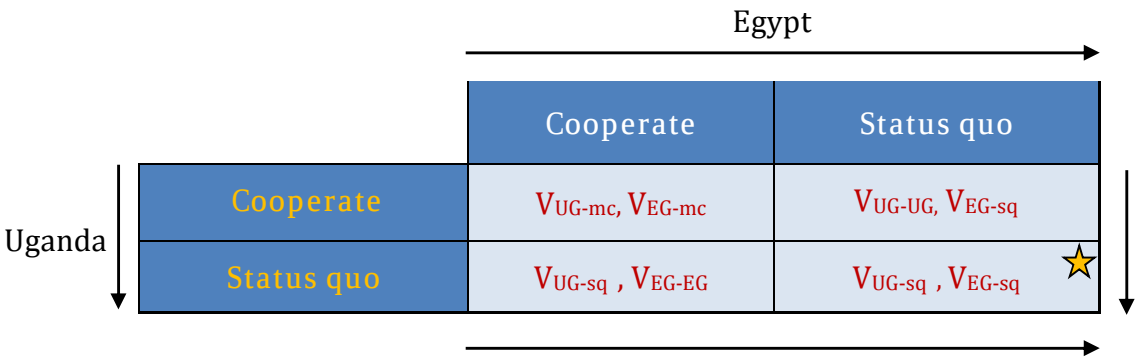


Table 7-9: Matrix of collective inaction game between Egypt and Uganda - equilibrium.

2.1.3.3 Results

As depicted above, this game is a special version of the prisoners' dilemma, where the two actors refuse to cooperate. The distinctive feature of this version is that both actors agreed implicitly to maintain the status quo because it served their interests. This was a result of the fact that the game was played simultaneously with other games played with the other riparian countries. Therefore, although Uganda has never recognised the Egyptian rights established by the treaty of 1929 and 1949, it has followed the path of its neighbouring upstream countries. Uganda informed Egypt that it had invoked the Nyerere doctrine or repudiated the existing treaties (Collins, 1990). Moreover, it preserved its Nile-related technical cooperation with Egypt established by the treaty of 1949. Furthermore, the Egyptian resident engineers at the Owen Falls Dam have maintained their offices at the dam site and continued their work with their Ugandan counterparts until today. On the other side, Egypt has continued its technical support to the Ugandan side, not only in the Nile-related cooperation established by the Nile water agreements but also in other fields, such as agriculture, health and education. Moreover, it has never pressed the Ugandan side for an official renewal of the Ugandan recognition of the Egyptian rights established by the treaties of 1929 and 1949.

3 Nile Basin Institutional Structure: early 1990s

This phase witnessed major changes that have significantly affected the Nile Basin until the present time. This major change was the result of the integration of one major formal institution and the evolution of an important informal institution. On the level of formal institutions, consolidation of the treaty of 1959 as a major formal institution had significant consequences on the institutional structure of the Nile Basin. On the level of informal institutions, the period witnessed the evolution of unilateralism as an informal institution that has characterised the Nile-related Ethiopian-Egyptian relations until the end of the study period.

The importance of this treaty was that it paved the way for the construction of the Aswan High Dam. Therefore, this treaty not only changed the institutional environment of the Nile but also changed significantly some of the features of the physical environment of the Nile. With regard to the physical environment, the construction of the High Dam resulted in changes in the effective annual discharge of the Nile to an average of 74 billion cubic metres. Moreover, it permitted Egypt to have control over the discharge of the Nile over the year. This enabled Egypt to overcome the problem of the shortage of water during the summer season. Concerning the changes in the institutional environment, the treaty increased Egypt's annual share of the Nile water from 48 billion cubic metres to 55.5 billion cubic metres. Similarly, it increased Sudanese share of the Nile water from 4 million cubic metres to 18.5 billion cubic metres.

The rigidity of the informal institutions of the Nile ownership between Egypt and Ethiopia led gradually to the institutionalisation of unilateralism as a new informal institution. The unilateralism gradually came to dominate the pattern of interaction between the two countries from the late 1950s. This informal institution caused a continuous tension in the relations between Egypt and Ethiopia that hindered the attempts at cooperation between the two countries. Furthermore, these strained Ethiopian-Egyptian relations led to a stagnation in the whole Nile Basin institutional environment.

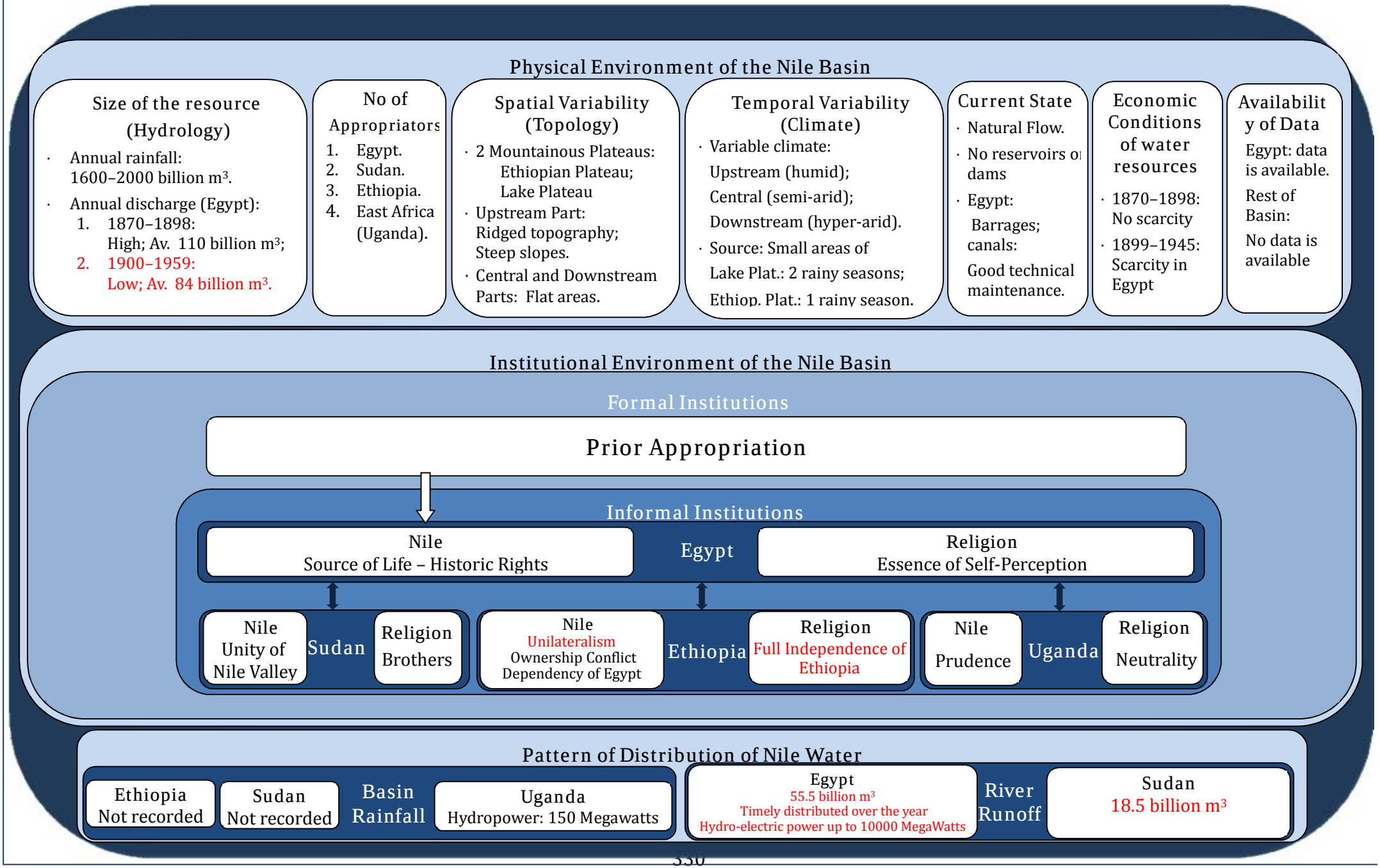


Diagram 7-3: Institutional structure of the Nile Basin, 1990s

3.1 Egyptian National Institutional Environment: early 1990s

This section explores the benefits of the basin-wide institutional change during this phase that filtered down to the Egyptian people. More specifically, it analyses how the different levels of the Egyptian institutional environment influenced the benefits from the treaty of 1959 and the construction of the Aswan High Dam which reached the Egyptian population. The analysis highlights the impact of the national institutional environment on the distribution of these benefits among the different segments of the society.

3.2 Formal Macro Institutions

The construction of the High Dam enabled Egypt to realise tangible benefits from the treaty of 1959. With regard to the increase in the annual supply of the Nile water, the High Dam reservoir, named Lake Nasser, provided Egypt with an annual water supply of 55.5 billion cubic metres instead of the previous mean annual of 48 billion cubic metres, of which around 22 billion cubic metres flowed annually, during the flood period from August to November, to the Mediterranean Sea (Abu-Zeid & El-Shibini, 1997). With regard to hydroelectric power, the hydropower plant of the High Dam has an installed capacity of 2.1 Gigawatts that can generate 10 billion kilowatt-hours (MkWh) per annum (Waterbury, 1979). The hydropower plant of the High Dam began to generate power in 1967 with an output of only 71 MkWh but the production was raised gradually to around 3700 MkWh in 1972, which represented around one half of the total power generation in Egypt, 7400 MkWh, at that time (Abu-Zeid & El-Shibini, 1997).

The Egyptian government attempted to generalise the benefits of the High Dam to the whole economy. Therefore, it embarked on comprehensive institutional change that included legislation to channel the benefits of the High Dam project to various sectors. The main sectors that benefited were agriculture, industry and the social sector.

3.2.1 Agriculture

The construction of the High Dam was expected to yield various benefits to the agricultural sector (Waterbury, 1979). Firstly, the cultivated agricultural area in Egypt was expected to expand by 1.2 million *feddan*s. Secondly, the government's target was to convert around 800,000 *feddan*s from basin irrigation to perennial irrigation. Furthermore, it was planned to expand the rice-producing lands by 1 million *feddan*s. Finally, it was predicted that the cultivation of the Delta would be improved as a result of lowering the level of the river which would enhance the drainage of these lands.

In general, the construction of the High Dam led to the partial or full achievement of some of the targeted objectives. These objectives were formally institutionalised by the first five-year plan for the period 1960–1965 that was enacted through a series of laws in 1959 (Rivlin, 2000). By 1972, out of the planned 1.2 million *feddan*s, about 600,000 were being cultivated, of which less than 350,000 had reached the marginal level of productivity (Waterbury, 1979). Another positive achievement was the conversion of all the land of Upper Egypt to perennial irrigation with significant increases in its productivity (Waterbury, 1979). Furthermore, rice-producing lands were expanded beyond the targeted acreage while maintaining good levels of productivity. Although the cultivation of the Delta was not improved and soil fertility declined, it was still within the acceptable margin of productivity and soil conditions during the early years of the 1970s.

The construction of the High Dam was accompanied by another major change in the agricultural sector. Three successive laws were enacted to improve the efficiency of the agriculture and irrigation. Three laws were enacted in 1952, 1961 and 1969 aimed at reforming the ownership of agricultural lands (Waterbury, 1979). These laws aimed at redistributing the agricultural lands that were owned by a few thousand families to a greater number of farmers. Another objective of these reforms was marginalising the landed-class elite families who were considered as allies of the previous regime and supporters of British interests (Waterbury, 1979).

Moreover, two important laws were issued in 1982 that affected the water-related sector. The first was Law no. 12 of 1982, regulating irrigation and drainage. This law regulated the management of public and private sector irrigation and drainage systems (Attia, 2004). It also regulated the operation of public and private water channels and provided legal directions for recovery of the cost of irrigation and drainage works (Attia, 2004). Unfortunately, these legal directions for cost recovery paved the way for neoliberal policies that eroded the privileges and the support that farmers enjoyed during the previous period. The second law was Law no. 48 of 1982 concerning the protection of the Nile and waterways from various sources of pollution. The law assigned the various tasks to the concerned entities and organised their relationships in the field of water resources.

3.2.2 Industrial Sector

The Egyptian growth strategy in the second half of the twentieth century focused on industrialisation. Egypt relied for nearly a century on its agriculture sector, especially on the exports of cotton, for its economic growth. However, the population growth outgrew the potential of the agricultural sector to provide the required land, employment and income to the growing population. Although Egypt enacted legislation during the first half of the 1950s to encourage private investment, it changed its orientation later to rely heavily on public ownership. In 1961, a series of decrees, came to known as the Socialist Decrees, were issued to nationalise the main banks and major industrial units (Rivlin, 2000). Furthermore, Egypt changed its foreign trade laws to adopt a protectionist import substitution policy with the aim to encourage its infant industries (Rivlin, 2000).

3.2.3 Social Sector

3.2.3.1 Food Subsidy

Food imports had become the government's responsibility in 1961 after a series of decrees suddenly nationalised all large-scale industry and finance; trade enterprises followed in 1963, and a national charter (Constitution-like) declared

socialism to be the basis of the economic system (Hansen & Nashashibi, 1975). The food subsidy system expanded in the 1960s and the 1970s, in terms of the number of food items, as a part of a broader social welfare programme adopted by the government (Ahmed, et al., 2001). This expansion gradually increased the burden on the public budget and negatively affected the quality of the subsidised food items.

3.2.3.2 Education and Health

The regulation of universal health services and public education became a priority for the Egyptian government during the 1950s and 1960s. After institutionalising free universal access to all levels of education in 1953, the government guaranteed employment in the public sector to all university graduates. This public commitment contributed to an escalation in university enrolment rates in the following years (Loveluck, 2012). These rights were institutionalised in the Constitution of 1956, the provisional Constitution of 1963 and the 1971 Constitution which was in force until the 2011 revolution. These successive constitutions maintained that education is a basic right that is to be provided by state schools for all different stages. Moreover, it was also enacted that work is a right that should be provided by the state to all Egyptians (Government of Egypt, 1956; Government of The United Arab Republic, 1964; Egyptian Presidency, 1971).

After the 1952 Revolution, health care provision was declared by the government to be the responsibility of the state. The government adopted a comprehensive plan to expand public hospitals and rural health care units all over Egypt (Tadros, 2006). Furthermore, free universal access to health care services was gradually institutionalised. Firstly, the 1956 Constitution declared that the state should provide facilities for an adequate level of health care services to citizens (Government of Egypt, 1956). Consequently, it was established as a constitutional right guaranteed by the state in the Constitutions of 1964 and 1974 (Government of The United Arab Republic, 1964; Egyptian Presidency, 1971).

3.3 Micro Institutional Structures

The agriculture reform initiated by the government in 1952 helped to increase agricultural production. However, the sector did not receive the full return from this growth as the government indirectly taxed it by imposing lower-than market prices to support the industrialisation process during this period. The objective was to transfer part of the surplus of the agriculture sector, the main sector in the Egyptian economy, to be used in the industrialisation plans and to be redistributed through the public social policies, which focused mainly on food subsidy, health and education (Waterbury, 1979).

The industrialisation strategy relied on two parallel processes. The first was the creation of new industrial units under public ownership. The second was the nationalisation of existing private enterprises. The starting point was the nationalisation of the foreign assets in 1957, including banks, insurance companies and foreign trade agencies (Rivlin, 2000). This was followed by a massive nationalisation in 1961 that included the majority of the industrial base of Egypt (Waterbury, 1979).

As indicated above, the food subsidy was heavily controlled by the Ministry of Trade and Supply (MOTS). The General Authority for Supply Commodities (GASC), an agency of MOTS, bought wheat from both local and international suppliers then supplied it to both public and contracted private mills (Ahmed, et al., 2001). The bakeries received this wheat at a subsidised price in return for selling a proportional amount bread with fixed standards, in terms of weight and shape, at a subsidised price fixed by the government. Most of these bakeries were privately owned and located in urban areas (Ahmed, et al., 2001).

The Ministry of Education (MOE) established three parallel educational systems under its supervision (El Baradei & El Baradei, 2004). The first included publicly funded and publicly managed schools that educate the majority of students. The second comprised privately funded and privately managed schools. The third is publicly funded and independently managed schools (Islamic religious Al-Azhar

schools) (El Baradei & El Baradei, 2004).

Similarly, three main public entities were made responsible for health care provision. The Ministry of Health (MOH) was the major healthcare provider running a nationwide decentralised system that ranged from outpatient clinics to large urban-based hospitals (Rannan-Eliya, et al., 2000). The Health Insurance Organisation (HIO), a compulsory social insurance agency, is the second major health care provider covering all formal sector workers and pensioners (Rannan-Eliya, et al., 2000). HIO was created in 1964 with the objective of eventually covering the whole population. (Rannan-Eliya, et al., 2000). The MOH jointly with the Ministry of Education finances and manages a limited number of specialised national teaching hospitals, which provide relatively high quality free care (Rannan-Eliya, et al., 2000).

With regard to drinking water, one important development in the water related sector was the assignment of various tasks to the concerned ministry by the Law no. 48 of 1982. The Ministry of Health and Population (MHP) was put in charge of monitoring and controlling the quality of water dedicated to domestic uses. Moreover, the Ministry of Water Resources and Irrigation (MWRI) was made responsible for regulating the quality of water through controlling the waste discharged from commercial and industrial entities (Attia, 2004). However, few industries that met the standards of Law no. 48 of 1982 were permitted to discharge to surface or groundwater systems (Attia, 2004).

3.4 Individual Level

The Egyptian economy grew during the period from 1960 to 1965 by around 6.5% (Waterbury, 1979). However, it is agreed that this growth figure was inflated by the accelerating growth of the civil service and public sector payroll (Rivlin, 2000). Moreover, although around 94% of the planned investment was implemented, industrial investment fell by 10% below its planned level. Furthermore, while the industrial sector failed to increase its exports, it received steadily growing volumes of imports, especially from the intermediate goods (Rivlin, 2000). Similarly, indirect

taxation of the agriculture sector resulted in a slow growth of the agricultural sector (Waterbury, 1979). Egypt suffered from a persistent deficit between its production and consumption of wheat that forced it to depend significantly on supplies of subsidised wheat from the United States (Waterbury, 1979). The situation was worsened by the defeat of Egypt in the 1967 War against Israel that stopped most of the development plans until the victory of Egypt in the war of 1973 against Israel.

The social structure of Egypt during this period underwent a significant transformation. The traditional influence of the land-owning elite class was limited. To the contrary, the middle class expanded and its capabilities were enhanced by the ruling regime during this period. However, poverty became more concentrated in the rural areas whose inhabitants had very limited capabilities.

With regard to the land-owner class, the three land reforms of 1952, 1961 and 1969 limited the land ownership of this segment. By the implementation of these reforms landholding was limited to 50 *feddan*s per person. As a result, the cultivated land owned by those traditional landowners, who represented around 5.2% of all landowners, declined from more than 5 million *feddan*s to around 1.9 million *feddan*s. This led to a decrease of the share of this class from more than 90% of the agricultural land to around 32% of it. Moreover, the share of this class in ownership of industrial production decreased to around 25% of the industrial production. However, it should be emphasised that their remaining wealth maintained for them strong capabilities in terms of nutrition, health care, education, and employment.

The main achievement of this period was the enlargement of the middle class and the improvement of their capabilities. The class was widened through the creation of a new petit (mainly rural) bourgeoisie through the successive land reforms. These reforms entailed the distribution of 800,000 *feddan*s to less than 400,000 families (Waterbury, 1979). This meant that about 14% of the cultivated land was distributed to around 10% of the rural families (Waterbury, 1979). The other segment of this class was the salaried workforce that was expanded by public employment which absorbed around 60% of the workforce (Waterbury, 1979).

The regime succeeded in enhancing the capabilities of this expanding middle class that came to represent more than 60% of the population. During the 1950s and 1960, 1 million jobs were created, mainly in the public sector (Rivlin, 2000). The income of the Egyptian workers doubled in the period 1952–1967 leading to an increase of 12% in the share of the lowest three quintiles of the population of the national income (Cook, 2012). The whole social sector (food subsidy, education and health care) was effectively managed by a package of moral and material incentives as well as strict monitoring and control. Drinking water infrastructure was extended gradually to almost all urban areas. Wheat was supplied to bakeries at subsidised prices and regulated bread prices were reasonable. At the same time, bakeries were subject to strong supervision by government. Therefore, subsidised bread was available at acceptable quality and price. Other food subsidies were expanded to include 18 food items during 1970s (World Bank, 2010). The expansion of public schools and hospitals was accompanied by giving adequate salaries to the workers in these two sectors as a part of the socialist policy adopted by government after the 1952. The early results were impressive and growth of the education system was ahead of that of the population. For example, the budgetary allocation to education witnessed a continuous growth reaching almost 48% of the total budget by 1959 (Tadros, 2006). The enrolment expanded from 1 million pupils in 1952 to 3 million a decade later (Tadros, 2006). The health care system was also expanding in an accelerating rate. Public health had become an idiom in the national discourse with continuous efforts to improve it (Tadros, 2006). This improvement of the living conditions of the middle class was reflected in the improvements of their capabilities. The rate of malnutrition in Egypt was reduced drastically during the 1960s (World Food Programme, 2005). Education improved intrinsic and instrumental knowledge capability. In other words, people had greater freedom to access to knowledge through education, which also granted them access to a guaranteed job in the public sector. Similarly, people had higher chances of living a healthy life by having access to practically free health care services of acceptable quality. In sum, the capabilities of the middle class became comparable to that of the elite class.

The poor classes, especially in rural zones, still suffered from lack of access to most of the basic capabilities. In spite of the rural–urban migration, the rural workers represented more than 40% of the workforce by the end of the 1960s. However, the agricultural workers maintained the lowest level of wages in the society as wages maintained their inherited stagnation (Mabro, 1967). However, it should be noted that rural workers started to benefit from the improved social services of the state during the 1960s. Drinking water infrastructure was extended to the main rural centres. Rural health units were established in the main centres and many of the private health care institutions were nationalised. Moreover, public schools were constructed in the main rural centres to serve their inhabitants.

However, it should be noted that the general enhancement of the capabilities of the Egyptian population was at the expense of their political freedom and capabilities of freedom of expression (Singerman, 1995). A one-party system covered a military-backed regime that controlled all political channels: parliament, trade unions, media and press (Posusney, 1997). Almost all participation accountability mechanisms were controlled during this period.

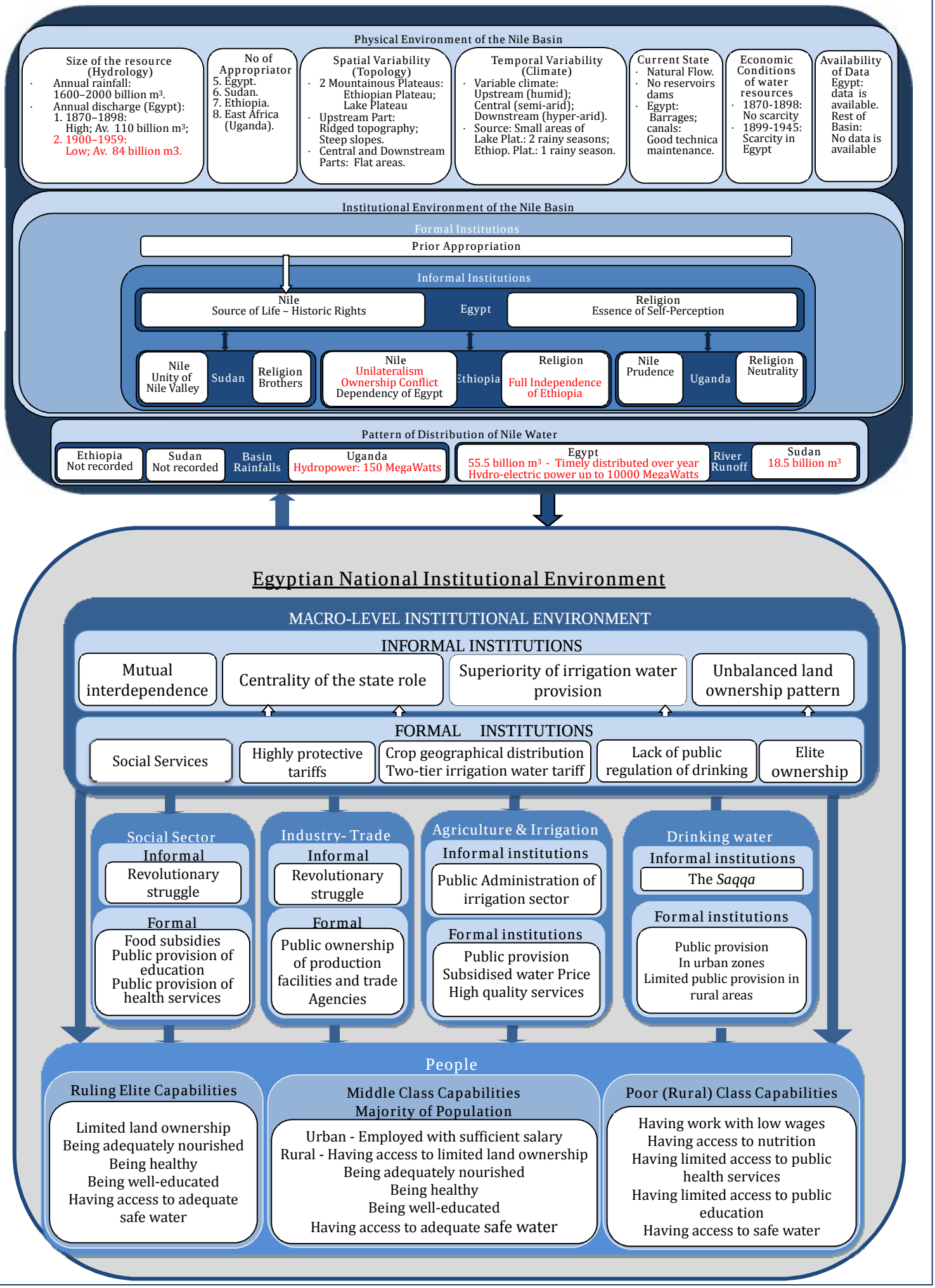


Diagram 7-4: Institutional structure of Nile Basin – Egyptian Institutional Environment, 1990s

3.5 Conclusions

The decolonisation of Egypt enabled it to embark on an aggressive modernisation plan. The main objective was to structurally transform the Egyptian economy from an agriculture-based economy to an industrial economy. Thus, the Nile policy of Egypt aimed at achieving three main goals. The first goal was to increase the amount of its utilisable water from the annual Nile discharge. Another important objective was to maintain a relatively constant annual water supply regardless of the annual fluctuations of the Nile floods. Last but not least, Egypt aimed at generating hydroelectric power to meet the needs of its industrialisation process. However, the failed attempts of Egypt to initiate the century storage project induce it to search for a storage project that lay within its borders. These Egyptian efforts gave birth to the proposal of the construction of the Aswan High Dam project.

The strategic interaction that preceded the construction of the High Dam revealed the increasing influence of the informal institutions on the choices of the riparian actors during these interactions and its outcome. The brotherly informal institutions between the Egyptian and Sudanese nations put pressure on the governments of the two countries to reach a settlement over the Nile water sharing and utilisation. To the contrary, the conflict of the informal institutions between Ethiopia and Egypt hindered the cooperation between them, leading to a series of chicken games between them. These chicken games lay behind the dominance of unilateralism in Ethiopia-Egyptian Nile-related interaction. The only exception was in the Egyptian-Ugandan interactions where neutrality of informal institutions enabled a more pragmatic pattern of interaction between the two countries.

On the national level, this period can be characterised by a balanced institutional environment that interpreted the benefits Egypt achieved from the signature of the 1959 treaty and the construction of the High Dam into enhancement of the capabilities of wide segments of the Egyptian population. Although the land-owning class maintained their inherited high capabilities, the urban middle class was enlarged and experienced a significant enhancement in their capabilities. The

main improvements to this class were in drinking water, food security, education, health and employment. Unfortunately, the benefits and entitlements that filtered down to the lower classes living in rural zones were marginal and scattered. However, the distribution of the direct and indirect benefits of the Nile water was more balanced and reached a wider segment of the population than in the previous period.

CHAPTER 8

BASIN-WIDE COOPERATION AND CURRENT CHALLENGES

The riparian countries began to change their orientation seriously from bilateral interactions to basin-wide cooperation in the 1980s. Furthermore, basin-wide cooperation started to materialise with the establishment of the Nile Basin Initiative in 1999. However, the failure to reach a consensus over a new governance system of the Nile Basin, the Cooperative Framework Agreement (CFA), among the riparian countries resulted in a serious hindrance of the cooperation process in the basin. Therefore, this chapter analyses this process of basin-wide cooperation mechanisms and the causes of its failure. Consequently, it provides an assessment of current challenges and new opportunities for future cooperation among riparian countries.

1 The Nile Basin Institutional Structure – 1997

This section begins by briefly exploring the changes in the conditions of the physical environment of the Nile Basin. Consequently, these changes will be linked to the actions of the riparian parties during this period. Finally, it examines the institutional environment of the Nile Basin.

1.1 Conditions of Physical Environment of Nile Basin

In general, the physical conditions maintained the status quo of the previous period. The Nile did not experience any natural changes in its physical conditions that had prevailed since the beginning of the twentieth century. However, human efforts have resulted in significant changes to its physical characteristics.

The Nile maintained the relatively low mean annual discharge that had occurred since the beginning of the twentieth century. More specifically, the Nile had an annual discharge of below 100 billion cubic metres during this period. Moreover, the Ethiopian plateau witnessed two acute drought seasons during the second half of the 1970s and the 1980s. These water crises motivated Ethiopia to seek more control over its water resources, including the Blue Nile. It is worth mentioning that

the escalating competitive behaviour among riparian countries during the period of the 1970s to 1990s led to a shortage in the data for the measurement of the Nile flow. This is reflected in Table 8-1 which was compiled from various academic sources due to the lack of official sources. Therefore, it can be said that the Nile has come to suffer from not only scarcity of water but also a scarcity of information.

Location	Average annual discharge in million m^3			
	1961–1970	1948–1970	1912–1982	
Dongola (Main Nile)	86.2	86.2	82.7	84.1 (1890–1995)
Mouth of the Atbara	10.9	12.1	10.6	11.1 (1903–1993)
Khartoum (Blue Nile)	45.9	49.8	50.1	48.3 (1900–1995)
Malakal (White Nile)	37.8	31.6	29.6	29.7 (1905–1997)
Mongalla (Bahr El-Jebel)	52.6	36.8	33.1	
Lake Albert exit	48.8	33.7	31.4	
Lake Kyoga exit	44.1	30.1	26.4	
Lake Victoria exit	41.6	29.4	27.2	

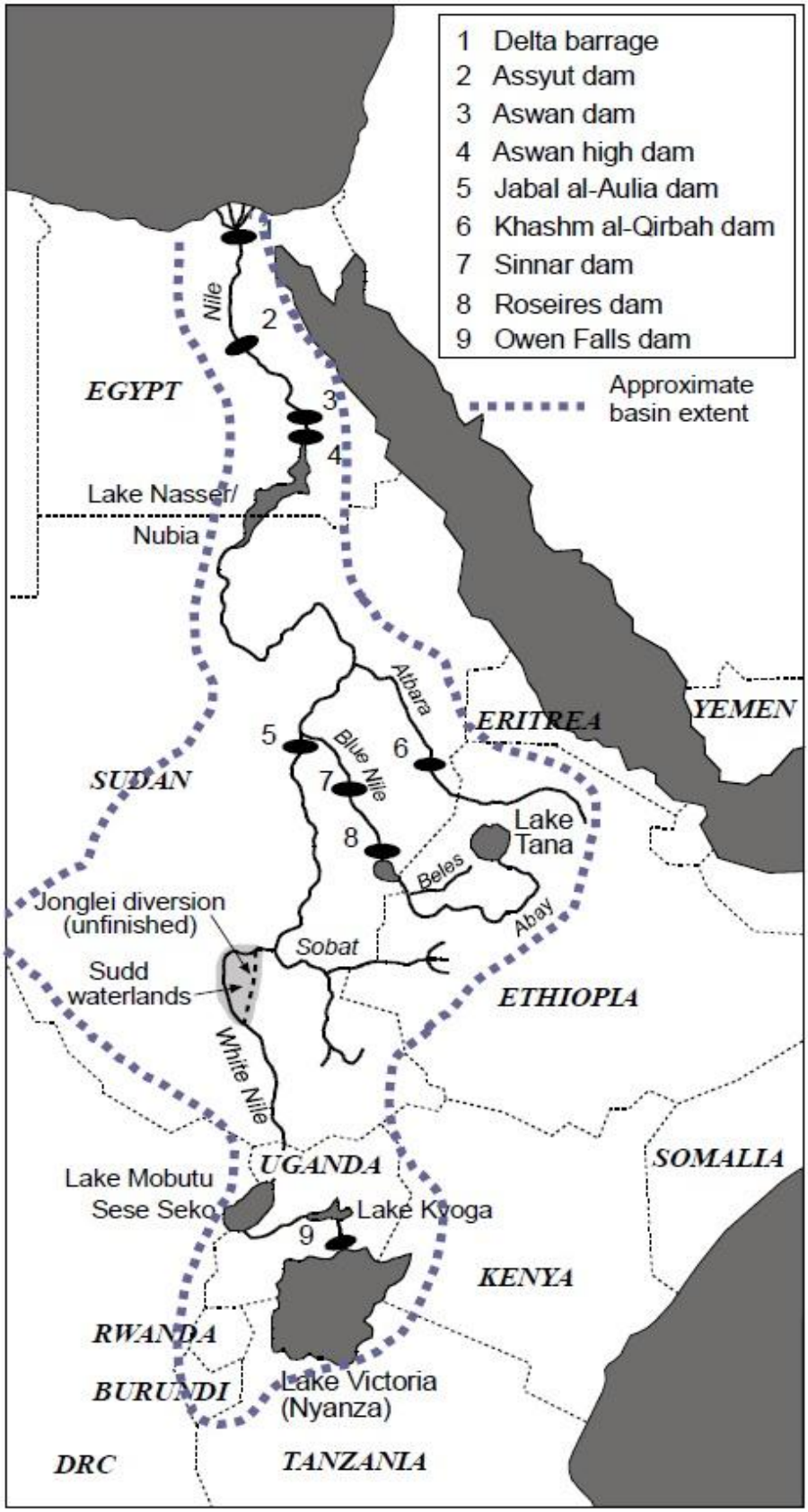
Table 8-1: Annual discharge of the Nile.

(Karyabwite, 2000; Sutcliffe & Parks, 1999)

With regard to the human made changes, three dams were constructed during the previous period that changed considerably the conditions of the physical environment of the Nile. The signature of the 1959 agreement enabled Egypt and Sudan to construct three major dams; the Aswan High Dam, the Roseires Dam and the Khashm El Girba dams in Sudan. As previously explained, the High Dam was

constructed with the objective of storing an entire year's Nile flood to permit Egypt to have a relatively constant annual flow. The dam was completed and had its turbines installed in 1972 with a total reservoir capacity of 157 billion cubic metres (Nicol, 2003). This capacity comprise a dead storage of 30 billion cubic metres and 93 billion cubic metres for live storage to accommodate the annual flood. The rest of the capacity of the reservoir was left to meet any extremely high flood (Nicol, 2003). The second dam is Kashem el-Girba, which was built on the Atbara River close to the Eritrean-Sudanese border. This dam was also constructed to serve the New Halfa irrigation scheme that was developed in Northern Sudan to compensate Nubians flooded as a result of the construction of the Aswan High Dam. The dam construction was completed in 1964. The dam was designed to have a storage capacity of 1.3 billion cubic metres, but this storage fell to little more than 0.5 billion cubic metres as a result of siltation. Finally, the Roseires Dam was constructed on the Blue Nile at the Damazin rapids near the Ethiopian-Sudanese border. The storage capacity of this dam is 3.0 billion cubic metres, which was raised to 6.8 billion cubic metres in its second phase (Nicol, 2003). The main objective of the dam was to provide the extensions of the Gezira Scheme with the necessary water. A secondary objective was the production of hydroelectric power for Sudanese power network.

By the construction of these dams, the total number of dams on the Nile rose to seven major dams as well as two barrages in Assyout and the Delta in Egypt (Map 8-1). This gave the Nile riparian countries, especially the downstream countries, greater control over the Nile River. The average water flow of the Nile from the different tributaries became stabilised and more or less predictable (Diagram 8-1).



Map 8-1 (not to scale): Major dams of the Nile Basin (Nicol, 2003)

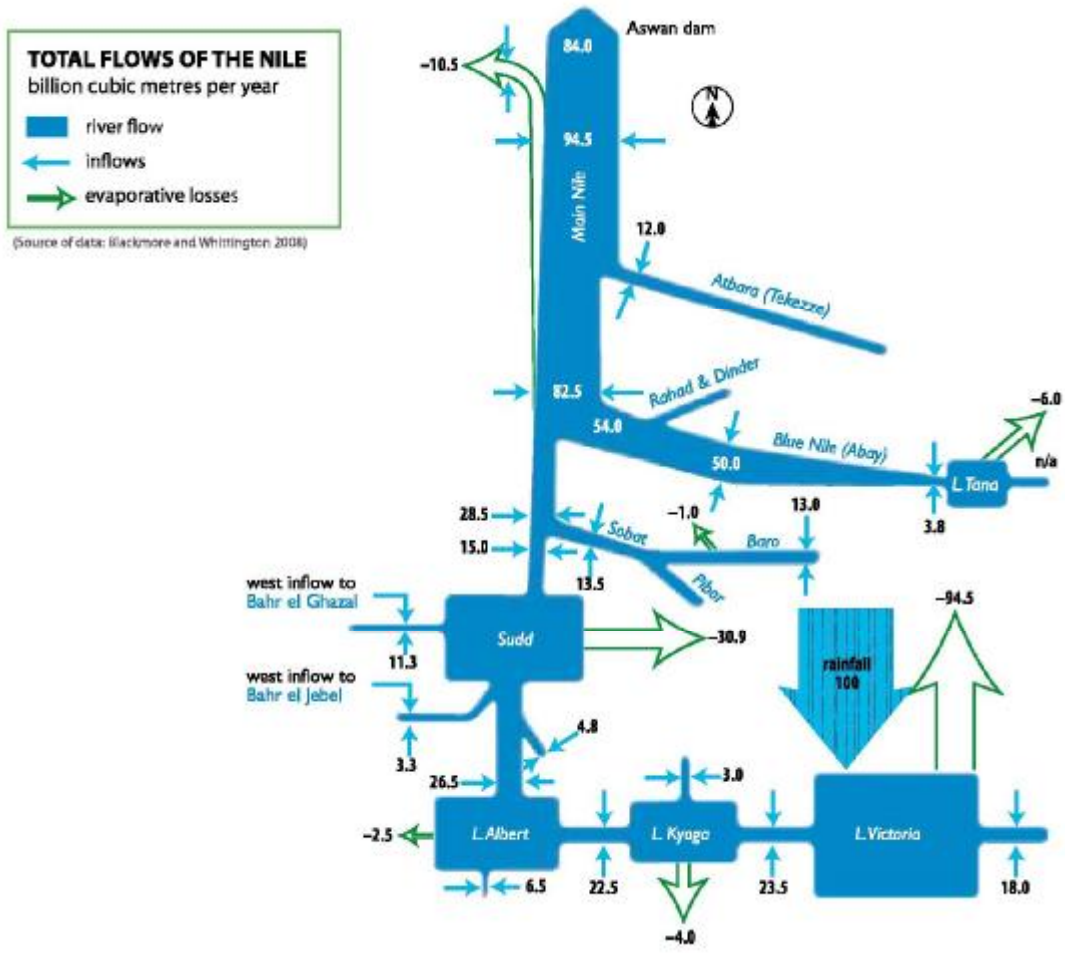


Diagram 8-1: Average water flows of the Nile (NBI, 2012).

It should be noted that efforts by riparian countries to regulate the Nile suffered from three main challenges that negatively affected their ability to control the Nile. The first was the failure of Egypt and Sudan to complete the construction of Jonglei Canal in the 1980s. The project was revived during the late 1970s based on the 1959 agreement. The project was supposed to be carried out in two phases. The first phase was estimated to add around 4.4 billion cubic metres to the annual Nile flood as measured at Aswan. The second phase was planned to include additional storage at Lake Albert and was estimated to add another 7.6 billion cubic metres to the annual Nile flood as measured at Aswan (Nicol, 2003). Although the construction of the canal began in the early 1980s, it was halted in 1983 after the completion of two-thirds of the main canal because of the resurgence of the civil war. The second problem that faced the riparian countries was the deterioration of the storage capacity of the dams as a result of siltation. This problem has been very acute

in the dams in Sudan whose storage capacity have fallen in some case below the half of its original capacity (Table 8-1). The third challenge has been the increasing population growth which resulted in persisting shortage of water resources in downstream countries and growing power shortage in the upstream countries, especially Uganda which had power coverage of only 9% of the country in 1990s (Mulira, 2010) .

Dam	Country	Year of Completion	Utilisation	River	Original Storage Capacity Billion m^3	Present Storage Capacity Billion m^3	Power Generation Installed Capacity Megawatts
Old Aswan Dam	Egypt	1902 heightened 1912–1934	Summer Irrigation, Hydroelectric power	Main Nile	5.2	5.2	550
Sennar Dam	Sudan	1925	Irrigation, Hydroelectric power	Blue Nile	0.37	0.37	15
Jebel Awliya	Sudan	1937	Flow Regulation	White Nile	3.22	2.54	
Owen Falls	Uganda	1954	Hydroelectric power, seasonal storage	Lake Victoria			150
Khashm El Girba	Sudan	1964	Irrigation	Atbara	1.30	0.56	
Roseires	Sudan	1966	Irrigation	Blue Nile	3.35	2.23	415
Aswan High Dam	Egypt	1972	Irrigation, Hydroelectric power	Main Nile	157	157	2100

Table 8-2: Dams of the Nile Basin.

(Nicol, 2003; Mulira, 2010; Mulat, et al., 2014)

In summary, although the physical conditions of the Nile Basin environment have become more regulated, the natural and demographical challenges put pressure on the Nile riparian countries to keep working to improve their utilisation of the Nile water. The political instability in Sudan and the deterioration of the capacity of the existing dams motivated Egypt and Sudan to seek more cooperation with upstream countries in order to find ways to increase their annual supply of Nile water to meet their water needs. Repeated droughts in Ethiopia motivated it to opt for better planning and utilisation of its water resources, including the Blue Nile. Finally, the need for electricity motivated all the riparian states, especially Uganda, to seek more hydropower generation from the Nile water.

1.2 Institutional Environment of the Nile Basin

This section briefly presents the main features of the institutional environment of the Nile at the beginning of the post-colonial period. It begins by mapping the state of informal institutions after the colonial period. Consequently, it explores the evolution of the formal institutions during the post-colonial period to trace its impact on the interactions among the riparian countries during the post-colonial period.

1.2.1 Informal Institutions

The Nile Basin has witnessed a gradual change in the dynamics of the relations among riparian countries that led to the integration of a negative informal institution in to its institutional environment. Relations between Egypt, and to a lesser extent Sudan, on one side, and the upstream countries on the other, have gradually declined. This persistence of the colonial institutional environment, which has been considered by upstream countries as favouring downstream countries, led to a belief that Egypt has backed this institutional structure to serve its interests. This informal institution can be described as the fallacy of Egyptian hegemony over the Nile Basin.

This informal institution has evolved gradually since the beginning of the 1970s for various reasons. Firstly, Egypt was engaged in the Arab-Israeli conflict from the 1960s with two wars against Israel. This forced Egypt to prioritise the Middle East over its neighbouring African countries (Boutros-Ghali, 2013). Therefore, most of its diplomatic and political efforts were directed to the Middle East, which was regarded negatively by the Nile riparians. Secondly, the involvement of Egypt in the Arab-Israeli conflict burdened Egypt with huge costs that negatively affected its economy, especially in late 1960s and in 1970s. This hindered Egypt from continuing the developmental role that it played in the 1950s and 1960s. Egypt changed from a rich economy to an indebted economy by the end of the 1960s. The situation became even worse as it became a heavily indebted country by the middle

of 1980s. Therefore, the Egyptian government was forced to give up gradually its developmental role in the African continent, including the Nile Basin (Boutros-Ghali, 2013). Moreover, it prioritised its relations with Western powers not only for political reasons but also for economic needs. This widened the gap between Egypt and its Nile co-partners. Last but not least, it should be emphasised that the most of the upstream countries fell into internal conflicts that prevented them from benefiting from the Nile (Tvedt, 2004). The failure of the upstream countries to improve their utilisation of the Nile was always covered by their regimes under the fallacy of the Egyptian hegemony. Although Egypt has not worked on changing the status quo of the Nile, it has not done the contrary. Egypt maintained the status quo because it did not have the resources to change it either positively or negatively. The failure of the Jonglei Canal project and the eruption of the civil war in Sudan, revealed the limits of the Egyptian power (Collins, 1971). Therefore, Egypt resorted to a defensive tactic that aimed to maintain the existing institutional structure until its economic and political situation improved.

In summary, the evolution of the informal institution of the Egyptian hegemony over the Nile into a fallacy was a result of the weakness of both Egypt and the upstream countries. On one hand, the heavy involvement of Egypt in Middle East conflicts negatively affected its political and economic capacity. On the other, the internal conflicts and political instability of upstream countries severely limited their ability to develop in general and to improve the utilisation of the Nile. These two concurrent trends led to divergence between the parties, with the weaker party blaming the relatively stronger as responsible for the deteriorated situation.

1.2.2 Formal Institutions

The adoption of the Convention on the Law of the Non-navigational Uses of International Watercourses by the United Nations General Assembly in 1997 represented a major step in the evolution of the international institutional environment governing transboundary rivers. Until the adoption of the UN Convention in 1997, the Helsinki rules were accepted by the international community as customary international law and represented the single most authoritative rules for regulating the uses of

international watercourses (Salman, 2007). However, the UN Convention, although it has recently entered into force in 2014, gradually became influential in the interaction among riparian countries in various river basins, including the Nile Basin.

1.2.2.1 UN Convention on the Non-navigational Uses of International Watercourses

The establishment of the United Nations Organisation (UN) in 1945 started a new phase not only in the development of the international watercourses but of international law in general. The UN General Assembly adopted a resolution on 8 December 1970 that mandated the International Law Commission (ILC)[8] to study the topic of international watercourses (Salman, 2007). The ILC begin working on the draft convention in 1971 and after a series of sessions in 1994 it recommended to the UN General Assembly draft articles to be the basis of the proposed declaration (Spiegel, 2005).

After three years of consultation among the UN member states, the Convention on the Law of the Non-navigational Uses of International Watercourses was adopted by the UN General Assembly on 21 May 1997 with the approval of 103 member states and the opposition of three states, Burundi, China and Turkey, while 27 member states abstained and 52 member states did not participate in the voting (Salman, 2007). The Convention was opened for signature on 21 May 1997 and remained open for three years, but only 16 member states signed the Convention (Spiegel, 2005). Although signature of the Convention was closed on 20 May 2000, states have the right to accede to the Convention by acceding to it through the approval of their legislative bodies of the Convention without having it signed (Salman, 2007). The Convention needed 35 instruments of ratification or accession to enter into force (Salman, 2007). Once the convention enters into force, it becomes not only a binding commitment for the signatory member states, but also it will represent a source of customary international law for all countries.

[8] The International Law Commission (ILC) is a UN subsidiary organ that is responsible for the codification and progressive development of international law. The commission is composed of legal experts who are nominated by their member countries and elected by the UN General Assembly.

The Convention is based in general on the work of ILA and IIL, but the Helsinki Rules embody many substantive rules in the Convention. The Convention adopts the principle of equitable and reasonable utilisation of international water courses. It states in Article 6 the factors that should be taken into consideration for determining such equitable and reasonable utilisation. These factors include:

> *(a) geographic, hydrographic, hydrological, climatic, ecological and other factors of a natural character;*
> *(b) the social and economic needs of the watercourse States concerned;*
> *(c) the population dependent on the watercourse in each watercourse State;*
> *(d) the effects of the use or uses of the watercourses in one watercourse State on other watercourse States;*
> *(e) existing and potential uses of the watercourse;*
> *(f) conservation, protection, development and economy of use of the water resources of the watercourse and the costs of measures taken to that effect;*
> *(g) the availability of alternatives, of comparable value, to a particular planned or existing use."*
>
> (FAO, 1998, p. 32)

One of the main contributions of the Convention is the balance it made between the equitable utilisation and the obligation of the riparian countries not to cause significant harm to other riparian countries (El-Rashidi, 2013). Like the Helsinki Rules, the principle of equitable utilisation is the guiding principle of the UN Watercourses Convention. The Convention also emphasises that the weight to be given to each factor should be determined by its importance in comparison to the other relevant factors in each case. However, the Convention dedicates a separate article, Article 7, to oblige the riparian state utilising the international watercourse to take all appropriate measures to prevent causing significant harm to other riparian states. Moreover, in case of causing significant harm, the riparian state that causes significant harm must take all appropriate measures to eliminate or mitigate such harm and, where appropriate, to discuss the question of compensation. It should be noted that, according to the Convention, the legality of using the water course depends upon the extent of legal harm caused by the riparian state to the

other riparian states, which is to be determined by a court, not by the parties in the case (Malla, 2009). In this way, the Convention has balanced between the equitable and reasonable utilisation and the commitment not to cause significant harm to other riparian countries.

It is important to note that the pattern of accession to the treaty reveals the resilience of the informal institutions of Nile riparian countries. Burundi explicitly voted against the Convention in the UN General Assembly. Egypt and Ethiopia have made reservations rejecting Article 6 on the equitable and reasonable utilisation of international watercourses. While Egypt emphasised the superiority of the historical and acquired rights of riparian states, Ethiopia asserted the sovereign rights of the riparian country over the part of the river that belongs to its territory. Moreover, with the exception of Rwanda, none of the Nile riparian states has acceded to the Convention.

2 Basin-wide Institutional Change: 1990s–2014

2.1 Context

Although the attempts to achieve basin-wide governance mechanisms began in the 1960s, it failed to achieve considerable success until the 1980s. Starting from the 1980s, a number of overlapping programmes were developed to deal mainly with Nile-related technical issues.

The first Basin-wide arrangement was the establishment of a hydro-meteorological programme (HYDROMET) to study the Equatorial Lakes Region in 1967 (McKenzie, 2012). The objective of this project was to assess the water balance of the Lake Victoria catchment area to enable the riparian countries to control both the water level of the lake and the water flow of the main Nile (Swain, 2002). HYDROMET was created by Egypt, Kenya, Sudan, Tanzania and Uganda with the assistance of the UN Development Programme (UNDP) (McKenzie, 2012). Consequently, Rwanda and Burundi joined the riparian countries in this project (Swain, 2002). However, Ethiopia did not join the programme before it came to an end in 1992 (Swain, 2002). This was among the main reasons that this programme did not develop into an effective basin-wide arrangement.

In 1983, another Basin-wide arrangement was established to strengthen the economic, social, cultural and technical ties among riparian countries. This arrangement was named UNDUGU, which means “brotherhood” in Swahili (Paisley & Henshaw, 2013). The creation of UNDUGU was the result of the efforts of the Egyptian government. All Nile riparian countries joined this mechanism except Ethiopia and Kenya, which participated as observers. The main achievement of UNDUGU was providing a forum for sharing information and experience among Nile riparian countries (Paisley & Henshaw, 2013). Furthermore, UNDUGU revolved the British tradition of treating the Nile Basin as a one unit by its beneficiaries.

The Nile riparian countries took another step forward in their cooperation drive by creating another technical cooperation mechanism at the beginning of the

1990s. The Council of Ministers for Water Affairs of All the Nile Basin (Nile-COM) formed the Technical Cooperation Committee for the Promotion of the Development and Environmental Protection of the Nile Basin (TECCONILE) in 1992. The main objective of TECCONILE was to promote cooperation and equitable development of the whole Nile Basin (Foulds, 2002). Six riparian countries joined this initiative as members while the other four participated as observers. The countries that held full membership of this mechanism as members were: Egypt, Sudan, Uganda, Tanzania, Rwanda, and the Democratic Republic of Congo. Ethiopia, Kenya and Burundi as well as Eritrea joined as observers. TECCONILE became operational at the beginning of January 1993 with its Secretariat located at Entebbe in Uganda (Swain, 2002). The main goal of TECCONILE was establish a basin-wide cooperation that could lead to the development of the Nile Basin in an integrated and sustainable manner.

To achieve this goal, TECCONILE aimed at developing infrastructure and building capacity for the water resources management and to formulate national master plans and integrate them into a Nile Basin Action Plan (Paisley & Henshaw, 2013). In general, TECCONILE made significant contributions to Nile-related data and information monitoring and analysis at Basin-level. Moreover, it played an important role in enforcing the capacity of Nile riparian countries in the field of technical monitoring. Furthermore, TECCONILE's action plan was adopted by the Nile-COM states in February 1995. The plan focused mainly on a number of development projects. However, few of these projects were carried out owing to resource constraints and the competitive behaviour of riparian countries towards one another (Paisley & Henshaw, 2013). Moreover, TECCONILE's action plan called for the establishment of a basin-wide framework that includes legal and institutional arrangements for governing the Nile Basin. This catalysed Nile-COM to endorse in its meeting in 1998 at Arusha in Tanzania a new programme of action that led to the formal creation of the present basin-wide cooperation mechanism, which is the Nile Basin Initiative (NBI) (Swain, 2002).

The Nile Basin Initiative was launched in 1999 as a new transitional institutional mechanism to replace TECCONILE, which had reached the end of its implementation term. The NBI was established as a transitional arrangement until

a permanent legal and institutional framework for the governance of the Nile water could be established. The NBI is composed of Nile-COM, a Technical Advisory Committee (Nile-TAC) and a Secretariat (Nile-SEC). The Secretariat inherited the headquarters of the TECCONILE Secretariat at Entebbe in Uganda.

The NBI adopted a process-oriented approach. This was interpreted in the vision adopted by the NBI, which emphasised that the initiative sought to achieve sustainable socio-economic development on the Nile Basin through the equitable utilisation of, and benefit from, the common water resources of the Nile Basin. To achieve this vision, two Subsidiary Action Programmes were created. The first is the Eastern Nile Subsidiary Action Program (ENSAP), which serves the eastern Nile region consisting of Egypt, Sudan, and Ethiopia. The second programme is the Nile Equatorial Lakes Subsidiary Action Program (NELSAP), dedicated to the Equatorial Lakes Region, including Egypt, Sudan, Uganda, Burundi, Democratic Republic of Congo, Kenya, Rwanda, and Tanzania. These programmes aim to achieve joint action to promote cooperation in poverty alleviation and economic growth of the two sub-basins. Moreover, the NBI launched a basin-wide Shared Vision Programme (SVP) that included a set of projects whose principal objective was collaborative action promotion, experience exchange, and capacity building. This joint programme for the development the Nile waters required significant financial resources. The World Bank and several donor countries, including Canada, Denmark, the Netherlands, Norway, Sweden, Japan and the United Kingdom have provided the necessary finance for the initiative and its programmes.

The distinctive feature of the NBI is that it includes all the riparian countries, including Ethiopia, as members for the first time. Only Eritrea participated as an observer. This represented a turning point in the history of cooperation among Nile riparian states. Until that time, Egypt remained the main driving force behind the Nile cooperation mechanisms while Ethiopia was keen to maintain the status of an observer in this mechanism without real involvement to avoid any commitment that might affect its claimed sovereign rights (Nicol, 2003). However, the end of the internal turmoil and the establishment of a new regime in the 1990s that had ambitious development plans induced the Ethiopian government to move gradually

towards cooperation with other riparian countries. This change of orientation was reflected in the Ethiopian diplomatic moves both on the regional and bilateral level. Regionally, Ethiopia became gradually more active in UNDUGU and its successor TECCONILE until it agreed to have full membership in the NBI. Bilaterally, after a series of positive public statements by the officials in Egypt and Ethiopia, the two countries signed a framework agreement for general cooperation between them. In this agreement, the two countries committed themselves to mutual consultation and cooperation in order to develop their Nile water resources. Unfortunately, neither of the two countries ratified this framework agreement. Moreover, both of them ignored it in their following interactions.

2.2 Cooperative Framework Agreement: Unfinished Action Situation

The NBI succeeded in launching negotiations over the establishment of a governance framework for the Nile water. The representatives of the riparian countries held numerous rounds of negotiations during a more than10-year period, starting from 2000, to draft a Cooperative Framework Agreement (CFA). However, these efforts did not succeeded in achieving consensus among the riparian countries over the final text of this agreement. This section will analyse the strategic interactions among riparian countries during this unfinished action situation.

2.2.1 Formal Analysis

2.2.1.1 Hypothetical Game

In the absence of informal institutions, the positions of the two actors would be shaped by two determinants. The first would be the treaties signed during the twentieth century. The second would be their economic and social needs in the light of the growing population in all Nile riparian countries.

The Egyptian position was based on two main sets of treaties. Firstly, the treaties of 1902 and 1929 that granted Egypt veto rights on the construction of any

irrigation projects on the Blue Nile. Secondly, the agreement of 1959 entitled Egypt to an annual water share of 55.5 billion cubic metres. However, Egypt has suffered since the 1970s from increasing water needs as a result of its rapidly growing population and economic development requirements (Nicol, 2003). Furthermore, Egypt has planned to establish new urban centres and industrial zones to absorb over one-fifth of its growing population (Swain, 2011). Egypt sought to increase its future water supply from the Nile, therefore, successive governments expressed publicly that the water share determined by the agreement of 1959 defined its minimum entitlement (Nicol, 2003). However, it should be emphasised that the main concern of Egypt, as a downstream country depending entirely on water coming from outside its boundaries, has been to secure the existing water rights according to these agreements. Therefore, the priority has always given to securing the existing share while the increase of water share has been regarded as a secondary objective. Egypt would not accept any new governance system unless it increases or at least maintain its established water share.

Although one can predict that the position of Sudan should be similar to Egypt, a closer look reveals some differences between the two positions. Sudan is estimated to be utilising nearly 15 billion cubic metres of its water share of 18.5 billion cubic metres established by the 1959 agreement (Nicol, 2003). However, this should be interpreted as an indication that Sudan has enough water supply to meet its needs. The civil war that erupted at the beginning of the 1980s slowed down the development drive in Sudan. If Sudanese development process maintained its pace of the 1960s and 1970s, Sudan would have been using its full share of water (Nicol, 2003). Moreover, it is estimated that Sudanese water needs will rise to around 32 billion cubic metres by 2025, mainly as a result of irrigation (Swain, 2011). It is worth noting in this regard that the agriculture sector is now more important in Sudan than it is in Egypt. While the Egyptian economy has been structurally transformed, although slowly, to industry and services, agriculture is still the main economic sector in Sudan. While the share of the population relying on agriculture for their livelihoods has fallen to less than 50%, more than 70% of Sudanese population is still dependent on the agriculture sector (Swain, 2011). Therefore, the

pressure on Sudan to increase its water supply has become higher than that of Egypt. Nevertheless, this Sudanese objective has been challenged by two main challenges. The first is the Egyptian opposition to any reduction in its established rights under the 1959 agreement. This meant that Sudan could not increase its water share of the available supply as a result of the construction of the High Dam and the 1959 agreement. The second challenge is that the opportunities of increasing the total water supply of the Nile water have diminished. The strained relationship between Egypt and Ethiopia have made the joint conservation project very unlikely. Similarly, the failure of the Egyptian-Sudanese project to construct the Jonglei Canal diminished the prospects of any future projects on the White Nile. The project was approved by the two countries as one of the fruits of the 1959 agreement. However, the eruption of the civil war that led to the independence of South Sudan in 2011 has diminished Sudanese hopes of increasing their water supply as result of this project. Therefore, in the absence of informal institutions, Sudanese position should seek to change the existing legal and physical conditions to increase its Nile water supply to avoid a future economic and social crisis.

A pragmatic Ethiopian position would have given priority to the development of hydroelectric power projects over irrigation projects. Although Ethiopia has a need to tackle the problems of both the power and agriculture sectors, the abundant rainfall in various areas means that the power problem is the more pressing. The agricultural sector represented 40% of the gross national product (GNP) of Ethiopia, employing 85% of the population, its exports accounted for 90% of the export income (Swain, 2011). Nevertheless, the majority of agricultural areas are highlands that enjoy high-rainfall (Swain, 2011). However, it should be noted that there are vast lands that have potential for irrigation in the future. Therefore, irrigation agriculture is considered important for future development but not a pressing problem as in the case of Sudan and Egypt. To the contrary, the problem of power generation has been persistent. Ethiopia attempted to solve the power problem through the construction of a series of small dams in the highlands in the 1990s, but these projects suffered from environmental degradation and deterioration in their efficiency. Therefore, hydropower generation would have topped the objectives of

the Ethiopian government in the absence of informal institutions. Clearly, this would be followed by the objective of the expansion of its agriculture sector. Therefore, the optimal strategy for Ethiopia would be to push for a new regulatory framework that recognises its right to construct mainly hydropower generation works and irrigation works if possible.

As previously indicated, Uganda's interests have been shaped by its need for hydroelectric power generation. Although Uganda has semi-arid lands in Karamoja in the northeast, the majority of its territories enjoy abundant rainfall (Mulira, 2010). This has permitted the country to rely extensively on rain-fed agriculture. Moreover, it has been estimated that the benefits of enhancing the efficiency the rain-fed agriculture could be enough to satisfy the needs of Uganda at least in the near future (Waterbury, 2002). To the contrary, Uganda's need to increasing its capacity for hydroelectric power generation became more pressing as the country has been facing a power shortage since 1986 (Mulira, 2010). The Ugandan government has related this power shortage to the drop in the water level of Lake Victoria (Mulira, 2010). Therefore, Uganda's main interest has been to secure high surface levels of Lake Victoria to release sufficient amounts of water to operate its existing and future dams. Uganda has two working dams, Owen Falls Dam with a capacity of 180 megawatts and Kiera with a capacity of 200 megawatts (Mulira, 2010). Uganda has plans to develop seven more dams with a total capacity of around 2250 megawatts (Mulira, 2010). Thus, Uganda's need for power takes priority in its hydrologic interests in the Nile. Moreover, the Ugandan government has been aware that a new institutional framework may permit the other riparian countries of Lake Victoria to increase their uses of the lake water. Since these additional uses would lower the lake level, the existing situation is safer for the hydrological interests of Uganda. Therefore, a pragmatic strategy for Uganda would entail seeking to maintain the status quo that provides it with optimal conditions for the operation of its current and future hydropower plants.

Participant	Position	Possible actions
Egypt	The owner of the Nile whose primary interest is maintaining its irrigation water share	Maintain the status quo
		New governance framework
Sudan	A beneficiary of the Nile whose primary interest is increasing its irrigation water share	New governance framework
		Maintain the status quo
Ethiopia	A beneficiary of the Nile whose primary interest is hydroelectric power and to a lesser extent in irrigation water	New governance framework
		Maintain the status quo
Uganda	A beneficiary of the Nile whose main interest is hydroelectric power	Maintain the status quo
		New governance framework

Table 8-3: Structure of hypothetical collective action game among riparian states.

The above analysis reveals the high possibility of formation of two alliances in this game. On one side, Egypt and Uganda would be candidates to form an alliance to maintain the status quo. This is an alliance that was described by Waterbury (2002, p. 151) as "the well-established wedding of Egypt and Uganda". On the other side, another alliance between Ethiopia and Sudan would be formed to change the existing governance framework. This alliance was also considered "natural" by Waterbury (2002, p. 151). Therefore, we would have a strategic game played between parties, where each party is composed of two allied actors. These two parties are: the Egyptian-Ugandan coalition and the Ethiopian-Sudanese coalition.

The valuations of the payoff of each outcome by each alliance could be deduced from the above-indicated pattern of preferences. On the Egyptian-Ugandan side, this alliance would prefer the option of maintaining the status quo ($V_{EgyUg\text{-}sq}$) over sacrificing unilaterally the water rights established by previous agreements ($V_{EgyUg\text{-}EgyUg}$).

$$V_{EgyUg\text{-}sq} > V_{EgyUg\text{-}EgyUg} \quad (8.1)$$

However, the preferences of this coalition between maintaining the status quo ($V_{EgyUg\text{-}sq}$) and reaching a new regime through negotiations ($V_{EgyUg\text{-}nf}$) would depend in the features of this new regime. If the new regime ignores the current rights of the downstream countries and establishes new rules for water sharing ($V_{EgyUg\text{-}nf1}$), then this coalition would seek to maintain the status quo.

$$V_{EgyUg\text{-}sq} > V_{EgyUg\text{-}nf1} \quad (8.2)$$

To the contrary, if the new framework would recognise the established shares and set rules for any additional future supply, they would prefer this new regime over the present as it paves the way for new water conservation projects while maintaining the existing rights of the downstream countries ($V_{EgyUg\text{-}nf2}$).

$$V_{EgyUg\text{-}nf\,2} > V_{EgyUg\text{-}sq} \quad (8.3)$$

The valuations of the payoff of different outcomes of Ethiopian-Sudanese alliance would reflect their ambition to replace the current regime with a new one that establishes new rules of utilisation and sharing that favour them. It is true that they would prefer to maintain the status quo ($V_{EthSu\text{-}sq}$) over sacrificing unilaterally their requests to redistribute the Nile water in a way that gives them a high share in its utilisation ($V_{EthSu\text{-}EthSu}$).

$$V_{EthSu\text{-}sq} > V_{EthSu\text{-}EthSu} \quad (8.4)$$

Similarly, their preferences between the status quo and a new negotiated governance framework would have two possible patterns. Contrary to the Egyptian-Ugandan alliance, the Ethiopian-Sudanese one would prefer a new framework that

redistributes the Nile water share regardless of the existing uses ($V_{EthSu-nf1}$) over maintaining the status quo ($V_{EthSu-sq}$).

$$V_{EthSu-nf1} > V_{EthSu-sq} \quad (8.5)$$

Moreover, it would value the status quo ($V_{EthSu-sq}$) higher than a new framework maintaining the existing rights ($V_{EthSu-nf2}$) as it would give the existing water uses of Egypt stronger legitimacy.

$$V_{EthSu-sq1} > V_{EthSu-nf2} \quad (8.6)$$

Therefore, this game could take two forms depending on the features of the proposed new governance framework. If the new governance framework ignores the current uses of the downstream countries and establishes new rules for sharing the Nile water that affect the downstream countries negatively (nf1), then the game would take the following form:

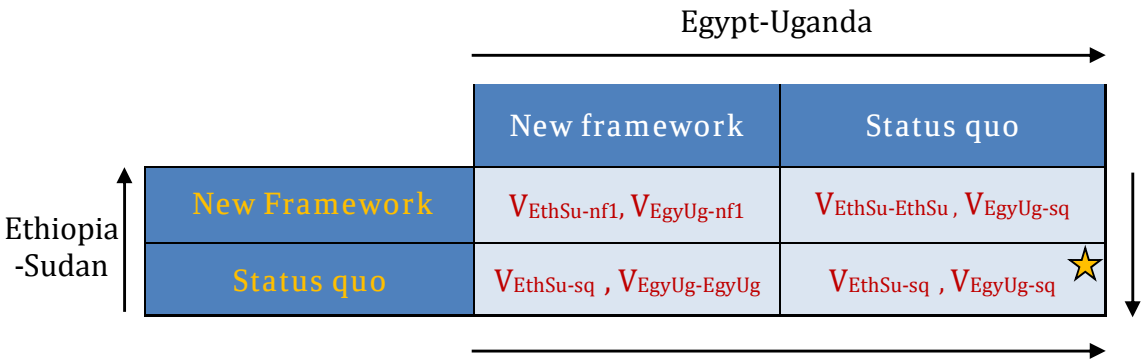


Table 8-4: Matrix of hypothetical collective action game among riparian states - New governance framework (nf1).

However, if the new framework recognises the existing uses of the downstream countries and sets rules for the additional water supply provided by future water conservation projects (nf2), then the game would take the following form:

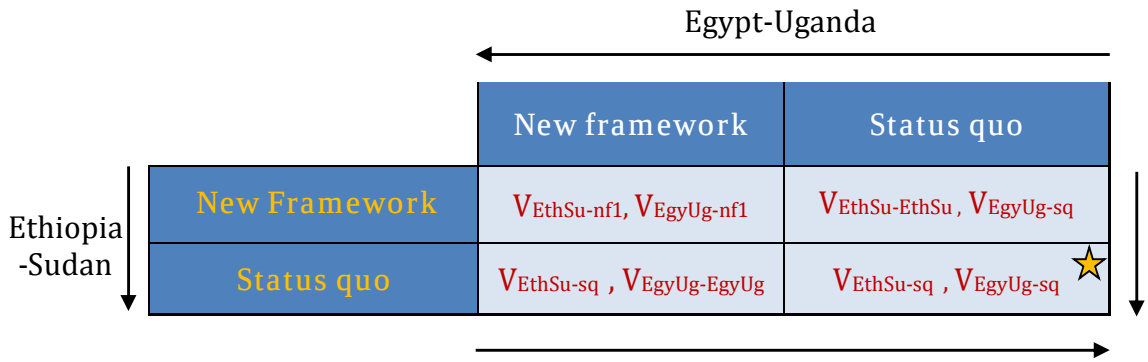


Table 8-5: Matrix of hypothetical collective action game among riparian states - New governance framework (nf2).

It is clear that the acceptable framework for one alliance would not be acceptable to the other. Therefore, the parties in this game have two options. The first is accept consensually maintaining the status quo until a change occurs in the balance of power among the actors, internal change in the economic or political state of one or more of the actors, or even shift in technology, which would result in a change of preferences of one or more of the actors in a way that leads the game to another equilibrium. The second option would be the collapse of the negotiations and the game with each coalition attempting to change the status quo in the way that serves its interest in a "tragedy of the commons" scenario. The Egyptian-Ugandan alliance would attempt to maintain the status quo by sticking to the existing governance framework established by the historical treaties. The Ethiopian-Sudanese alliance would attempt to establish a new governance framework by formalising a new governance agreement that established new rules for the utilisation of the Nile water.

2.2.1.2 Real Game

In reality, the technical positions of the main actors have been shaped by the inherent informal institutions as well as those evolved during the twentieth century. It should be emphasised also that the behaviour of the actors in this action situation was influenced by the conclusion of the UN Convention on the Law of Non-navigational Uses of International Watercourses. Although the convention was not

in force at the time of negotiation its principles influenced the positions of the actors.

The position of Egypt was formulated by a combination of its informal institutions of ownership of the Nile and brotherhood with Sudanese nation, as well as the formal institutions established by the treaties of 1902, 1929 and 1959. Similarly, Sudanese position was shaped by a mix of the informal institution of their brotherhood with Egyptians and the formal institution of the 1959 treaty. To the contrary, Ethiopia had its position based only on informal institutions, which included its ownership of the Blue Nile as well as the newly developed informal institution of Egyptian hegemony over the Nile. The country that experienced a significant change in the basis of its strategic position was Uganda that had among the determinants of its position informal institutions. The informal institution of Egyptian hegemony was integrated gradually to the Ugandan culture and become one of the determinants of the Ugandan position in its strategic interactions with Egypt.

The positions of actors and the alliances formed in reality revealed the influence of informal institutions on the preferences of those actors. Sudan allied with Egypt, adopting a position that demanded recognition of the current uses. This position is less profitable to Sudan than that calling for maintaining the rights established by the 1959 agreement as the current water usage of Sudan is estimated to be around 15 billion cubic metres, which is less than its share of 18.5 billion cubic metres established by the above-referred agreement. Some writers have argued that Sudanese position was politically "dominated" by Egypt (Nicol, 2003, p. 20). However, this argument can be refuted easily as the period witnessed a severe conflict between the regimes of the two countries because of the Egyptian accusation of Islamist Sudanese regime of attempting to assassinate the Egyptian President Hosni Mubarak in the 1990s. Sudanese position was influenced by the common belief of the nations in their deep brotherly link. On the other side, Uganda allied with Ethiopia in its attempt to lead the negotiations to a new framework that ignored any previous commitments. This new position was mainly influenced by the feeling of Ugandan that Egypt had been trying to impose its hegemony, ignoring the development needs of the other riparian countries. The domination of the informal

institution of the Egyptian hegemony of the Nile was reflected not only in the position shift but also in the declarations of the Ugandan officials. Although Uganda was "locked" with Egypt by their common objectives, "Uganda has resented Egyptian hegemony, or at least high-handedness, in the Nile basin as much as any other riparian" (Waterbury, 2002, p. 151). Therefore, Ethiopia and Uganda, as well as the other equatorial upstream countries, formed a coalition to press for the establishment of a new framework to regulate the Nile water utilisation that does not recognise the existing water rights or uses.

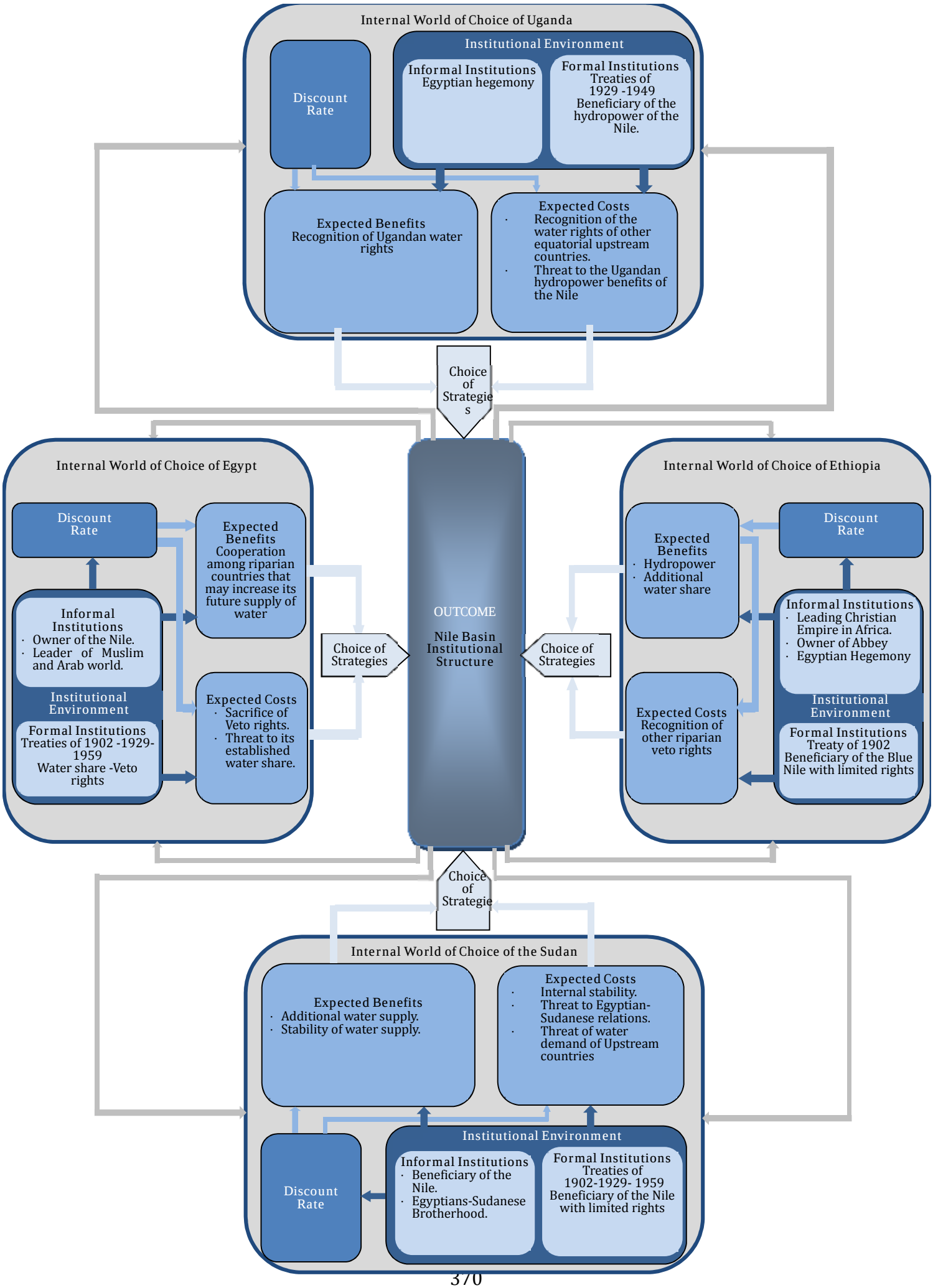


DIAGRAM 8-2: STRATEGIC INSTITUTIONAL CHANGE: Egypt- Sudan-Ethiopia-Uganda

Therefore the action situation took the form of strategic game between two alliances: an Egyptian-Sudanese alliance and an Ethiopian-Ugandan alliance. On the one hand, the Egyptian-Sudanese coalition attempted to maintain the status quo or establish a new regime that recognised the status quo. On the other hand, the Ethiopian-Ugandan coalition pressed for the formalisation of a new framework agreement that established rules of water sharing that minimise the weight of the established rights and the current uses.

The valuations of the payoff of each outcome by each alliance were similar to those of the hypothetical game, with one exception. This exception was that Sudan and Uganda changed position in the alliance. Sudan became partner of Egyptian in its efforts to maintain the status quo while Uganda became a key member of the Ethiopian alliance to change and redistribute the water quota, ignoring previous agreements. The Egyptian-Sudanese coalition clearly preferred the outcome that would maintain the status quo ($V_{EgySu\text{-}sq}$) over sacrificing unilaterally the water rights established by previous agreement ($V_{EgySu\text{-}EgySu}$).

$$V_{EgySu\text{-}sq} > V_{EgySu\text{-}EgySu} \tag{8.7}$$

Similar to the previous game, the choice of this Egyptian-led coalition between the status quo ($V_{EgySu\text{-}sq}$) and the establishment of a new regime through negotiations ($V_{EgySu\text{-}nf}$) was determined by the content of this new agreement. If the parties reached a framework that ignored the current uses of the downstream countries, it would be valued ($V_{EgySu\text{-}nf1}$) less than the status quo.

$$V_{EgySu\text{-}sq} > V_{EgySu\text{-}nf1} \tag{8.8}$$

Nevertheless, if this new agreement would have recognised the current uses, it would be valued ($V_{EgySu\text{-}nf2}$) higher than the status quo.

$$V_{EgySu\text{-}nf\,2} > V_{EgySu\text{-}sq} \tag{8.9}$$

On the other side, the valuations of the payoff of different outcomes for the Ethiopian-Ugandan alliance reflected their desire to establish a new framework

regulating water utilisation and sharing that favoured them. They preferred to maintain the status quo ($V_{EthUg-sq}$) over sacrificing unilaterally their requests to redistribute the Nile water ($V_{EthUg-EthUg}$).

$$V_{EthUg-sq} > V_{EthUg-EthUg} \quad (8.4)$$

Moreover, the Ethiopian-Ugandan alliance preferred a new framework that redistributed the Nile water share from scratch ($V_{EthUg-nf1}$) over maintaining the status quo ($V_{EthUg-sq}$).

$$V_{EthUg-nf1} > V_{EthUg-sq} \quad (8.5)$$

To the contrary, they valued the status quo ($V_{EthUg-sq}$) higher than a new framework protect the current uses ($V_{EthSu-nf2}$).

$$V_{EthUg-sq1} > V_{EthUg-nf2} \quad (8.6)$$

The game had two probable outcomes, like the hypothetical game. The first outcome would have occurred if the negotiations led to a framework that protected existing uses of downstream countries and set rules for the additional water supply provided by future water conservation projects (nf2). The game would have taken the form as in Table 8-5:

		Egypt-Sudan: New framework	Egypt-Sudan: Status quo
Ethiopia-Uganda	New framework	$V_{EthUg-nf1}$, $V_{EgySu-nf1}$	$V_{EthUg-EthUg}$, $V_{EgySu-sq}$
Ethiopia-Uganda	Status quo	$V_{EthUg-sq}$, $V_{EgySu-EgySu}$	$V_{EthUg-sq}$, $V_{EgySu-sq}$ ★

Table 8-5: Matrix of the real collective action game among riparian states – Probable outcome 1.

The parties would have two available outcomes. The first, would have been to maintain the status quo or to preserve the situation where Egypt and Sudan sign a governance framework without the approval of the rest of the parties in a scenario similar to the treaty of 1959. However, this was not the outcome reached in this action situation. Since the Ethiopian-Ugandan alliance was supported by the equatorial upstream countries, they succeeded to gain the support of the majority of the Nile riparian countries to a draft of a new framework agreement that established rules for sharing the Nile water without protecting the existing uses of downstream countries (nf1), therefore, the game took the form as in Table 8-6:

Ethiopia -Uganda \ Egypt-Sudan	New framework	Status quo
New framework	$V_{EthUg-nf1}$, $V_{EgySu-nf1}$	$V_{EthUg-EthUg}$, $V_{EgySu-sq}$
Status quo	$V_{EthUg-sq}$, $V_{EgySu-EgySu}$	$V_{EthUg-sq}$, $V_{EgySu-sq}$ ★

Table 8-6: Matrix of the real collective action game among riparian states - Probable outcome 2.

The Ethiopian-led alliance refused to maintain the status quo. Moreover, in May 2009 at an extraordinary meeting held in Kinshasa, this alliance adopted a draft of the CFA that was not accepted by Egypt and Sudan (Arsano, 2011). Therefore, the negotiations collapsed with the Ethiopian-led coalition approving the draft while the Egyptian-Sudanese coalition rejected it and refused to sign it. Although the draft of the Cooperative Framework Agreement that was adopted by the Ethiopian-led coalition adopted the two major principles of the UN Convention on the Law of Non-navigational Uses of International Watercourses – the equitable and reasonable utilisation and the obligation not to cause significant harm to other riparian parties – the coalition refused to protect either the established rights or the current uses. The primary issue that prevented the universal adoption of the CFA was Article14.b, presented by Egypt and Sudan, which states that riparian countries are "not to adversely affect the water security and current uses and rights of any other Nile

Basin State" (Paisley & Henshaw, 2013). The Ethiopian-led coalition proposed a version of the article that stated that "Nile Basin states agree not to significantly affect the water security of any other Nile Basin state" (Bitsue, 2012). Unfortunately, each of the two parties insisted on its version of the article. Moreover, the Ethiopian-led alliance approved the draft CFA, including an article that empowered the Nile Basin Commission established by the agreement to resolve the matter within six months of its establishment. On the other side, Egypt and Sudan proposed instead to establish the Nile Basin Commission before approving the final draft of the CFA to resolve the problem of the disputed articles, but this proposal was rejected by the Ethiopian-led coalition (McKenzie, 2012). As a result of this disagreement, deadlock ensued with the Ethiopian-led coalition approving an agreement that was not recognised by the Ethiopian-Sudanese side (Paisley & Henshaw, 2013). Moreover, this draft of the CFA has been signed by six countries: Ethiopia, Uganda, Rwanda, Burundi, Kenya and Tanzania, while three countries: Egypt, Sudan and the Democratic Republic of Congo, refused to sign it. Moreover, Egypt and Sudan have frozen all their activities in the Nile Basin Initiative until the "legal ramifications" of the signed CFA can be resolved (Paisley & Henshaw, 2013). This action was taken by Egypt and Sudan to mark their opposition to the action taken by the other riparian countries. This Egyptian-Sudanese move has put pressure on the other riparians as the international financial support for most of the projects of the NBI stopped as a result of this conflict (Swain, 2011). This has resulted in a hydropolitical deadlock between the Ethiopian-led and the Egyptian-led coalitions.

3 Nile Basin Institutional Structure: Year 2014

This period was influenced by two institutions that were newly integrated in the institutional structure of the Nile Basin. The first is the informal institution of the fallacy of the Egyptian hegemony that had evolved over the second half of the twentieth century. The second is the UN Convention on the Law of Non-navigational Uses of International Watercourses that has been integrated to the international institutional environment governing the Nile by its entry into force in August 2014.

A basin-wide conviction that Egypt has been imposing its will over the other riparian countries had been evolving during the second half of the twentieth century. Although this belief does not accurately describe the evolution of the inter-riparian relations in the post-colonial period, it has become widely accepted among the Nile upstream countries. This new informal institution has had a negative effect on the interactions among riparian countries. It led to a rigidity in the positions of some riparian countries in their interactions with Egypt. One important challenge for Egypt is to remove this negative informal institution from the institutional structure of the Nile Basin over the next years.

While the adoption of the UN Convention on the Law of Non-navigational Uses of International Watercourses by the UN General Assembly marked the beginning of this study phase, its entry into force marked its end. Although the convention has not entered into force until recently, it influenced the strategic interactions among the riparian states. Firstly, it catalysed the efforts of the riparian state to move from bilateralism to a basin-wide pattern of interaction. Secondly, various principles in the disputed CFA were imported from the convention. Furthermore, although almost all the riparian states, with the exception of Rwanda, have neither signed nor ratified it, the Convention become part of the formal institutional environment that governs the Nile as it has become part of international customary law since its entry into force. Therefore, its impact on the interactions among riparian countries is expected to grow.

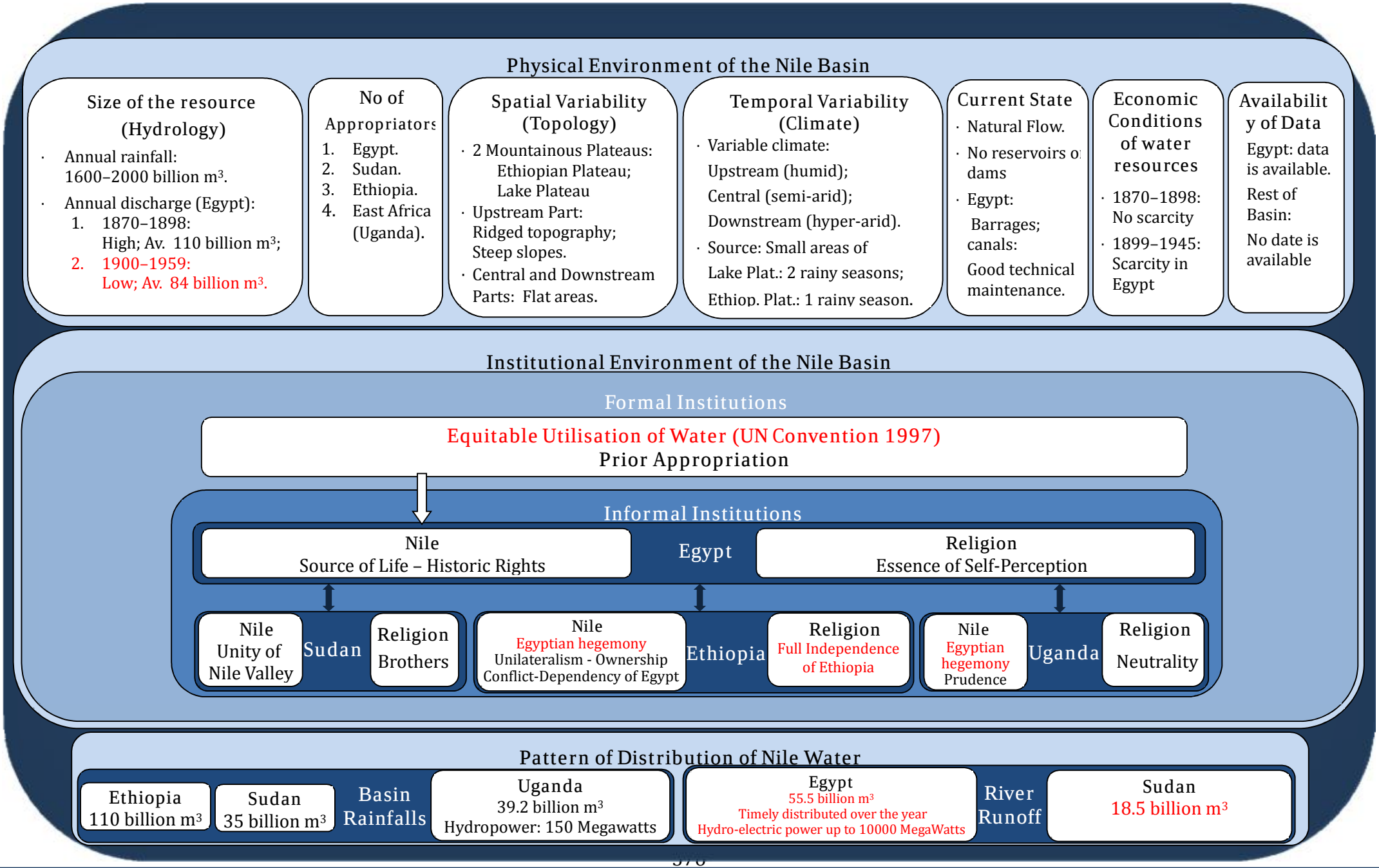


Diagram 8-2: Institutional structure of the Nile Basin, 2014.

3.1 Egyptian National Institutional Environment: 2014

Although the water supply secured to Egypt by the 1959 agreement and the High Dam was enough in the 1970s and early 1980s, the water demand in Egypt has increased tremendously in the last 30 years. This has resulted in an increasing water deficit in Egypt that was met by recycled water processes. However, this deficit is expected to increase in future years as a result of the growing population. Therefore, it is important to assess the current allocation of water resources and its benefits to people to be able to achieve a better water use planning for the future.

The annual renewable water resources of Egypt without water reuse comprises the water released from Aswan High Dam as well as annual rainfall. The total of annual renewable water resources is estimated to be 56.8 billion cubic metres (MWRI, 2005a). Egypt has developed over the years a complicated network of canals and barrages to supply the different sectors and regions with their needs (Diagram 8-1). Agriculture and fisheries consume around 86% of the available fresh water supplies, excluding recycled water, while the industrial and domestic sectors utilise on average 8% and 6% of these supplies (MWRI, 2005a). The other uses, including navigation and hydropower generation, are instream users that do not consume water (MWRI, 2005a). However, the growing population has forced Egypt to increase the efficiency of its water utilisation by resorting to reuse of recycled water.

Although Egypt has attempted to develop alternative reused sources of water to meet the increasing demand, the Nile still represents its main source of water. The current total water supply of Egypt, including reused water, was estimated to be 87.75 billion cubic metres in 1997 (MWRI, 2005a). The Nile water released from the High Dam (55.5 billion cubic metres) and rainfall (1.3 billion cubic metres) amounted to 56.8 billion cubic metres. The additional 30.95 billion cubic metres came from ground water and reused water. The deep ground water supply amounted to 0.9 billion cubic metres per year. The agricultural drainage system reinjected around 18.55 billion cubic metres back into the water supply. Recycled

industrial water accounts for 6.8 billion cubic metres while another 3.8 billion cubic metres came from recycled municipal water. Finally, fisheries reinject 0.9 billion cubic metres into the Egyptian water supply system.

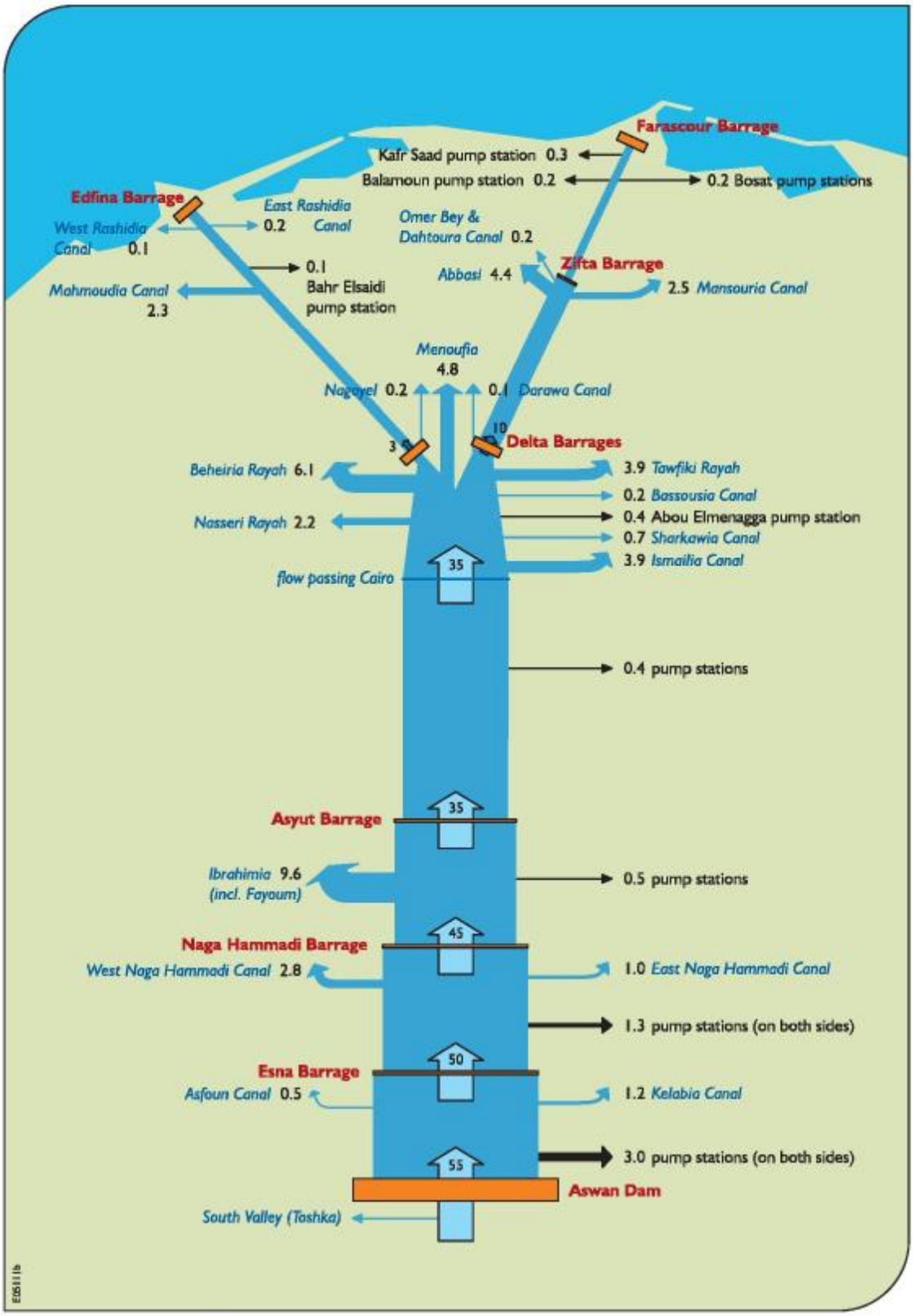


Diagram 8-3: Nile water distribution system in Egypt (MWRI, 2005a).

The distribution of the water demand in Egypt is divided between agriculture, industry, municipal use and fisheries (MWRI, 2005a). Although the share of agriculture of the total water supply includes reused water, it still represents the highest share. In 1997, the agricultural sector consumed 58.65 billion cubic metres, which represented nearly 67% of the total water supply of Egypt. In same year the industrial sector consumed around 7.5 billion cubic metres, which amounted to about 8.5% of the total water resources. Moreover, the domestic water consumption was estimated to be around 4.75 billion cubic metres, representing around 5.5% of the water resources. Finally, fisheries used only 1.5% of the total water available in the system. The rest of the water, which amounted to 15.55 billion cubic metres and represents nearly 18% of the water supply, was disseminated from the Nile system to outside sinks. This disseminated water comprised of the water released to the Mediterranean Sea (13.1 billion cubic metres), evaporation (2.4 billion cubic metres) and a very small proportion (0.05 billion cubic metres) sank into desert areas.

	Supply In billion m^3	Demand/Consumption In billion m^3	Consumption share
Aswan High Dam	55.5	-	-
Rainfall	1.3	-	-
Deep Ground Water	0.9	-	-
Agricultural Sector	18.55	58.65	67%
Industrial Sector	6.8	7.5	8.5%
Domestic use	3.8	4.75	5.5%
Fisheries	0.9	1.3	1.5%
Mediterranean Sea	-	13.1	15%
Evaporation	-	2.4	2.75%
Desert	-	0.05	0.05%
Total	87.75	87.75	100%

Table 8-7: Water balance of Egypt in 1997 (MWRI, 2005a).

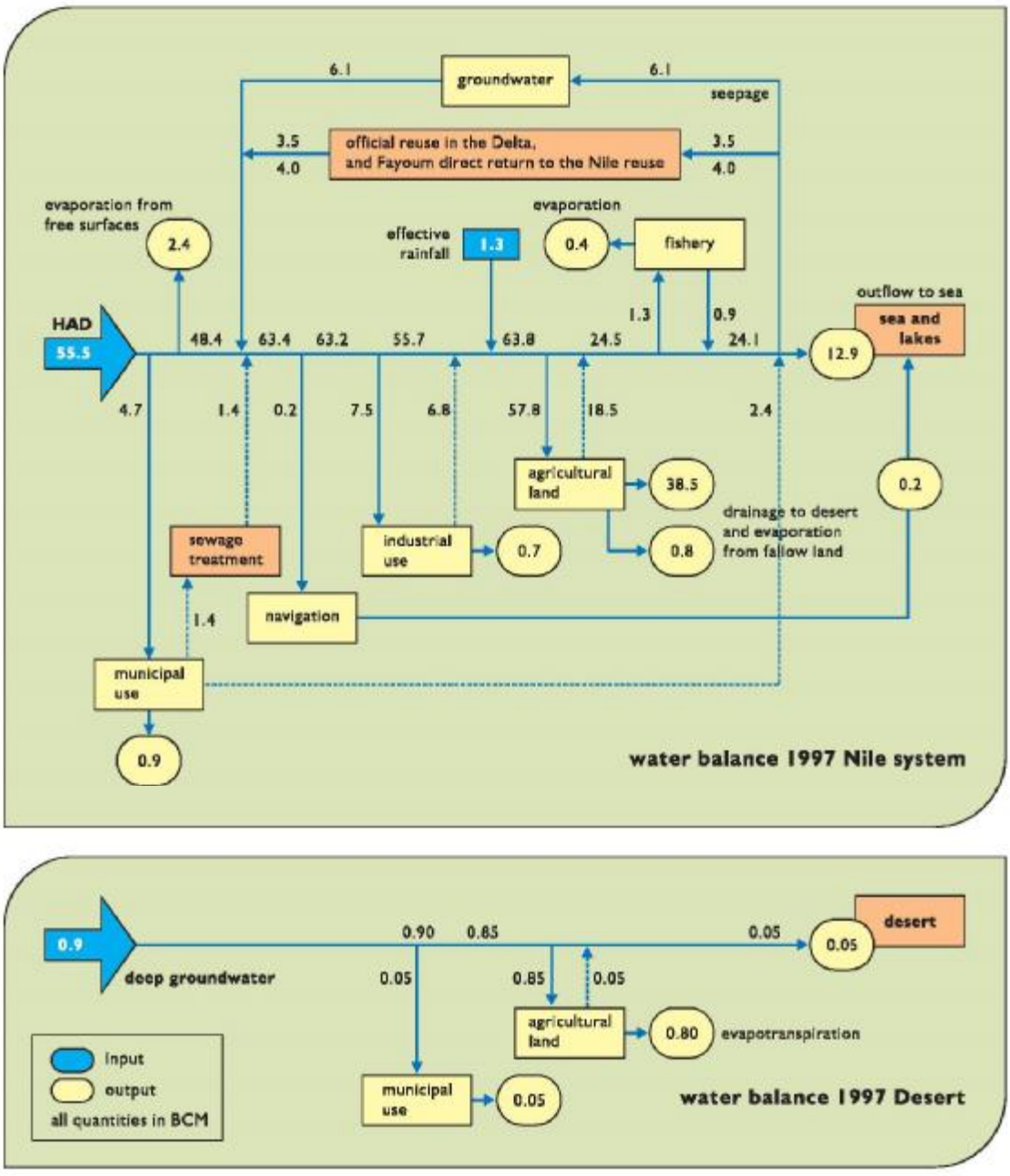


Diagram 8-4: Water balance in Egypt in 1997 (MWRI, 2005a)

Various studies have indicated that actual water consumption in Egypt exceeds the planned water supply. In 2005, it was estimated that Egypt had a supply gap of 4.8 billion cubic metres which was being met by the unused water of Sudan's share (Doss & Milne, 2005). Moreover, this supply gap has been increasing during the last few years. The agricultural sector has been the main contributor to this supply gap. Land reclamation has been a priority for the successive Egyptian governments since the construction of the Aswan High Dam to meet the rapidly

growing population. Egypt succeeded in expanding the cultivated agricultural lands by 2.5 million *feddan*s during the second half of the twentieth century (Attia, 2004). However, this growth in agricultural land has lagged behind the needs of the growing population. Therefore, Egypt planned to add another 3 million *feddan*s to its cultivable areas during the next decade (Doss & Milne, 2005).

Opportunities to close this increasing gap between the supply and demand for water in Egypt are limited. Although Egypt declared an ambitious plan to save around 19.1 billion cubic metres by 2017, this plan would not allow for the continuously increasing demands for other uses. The annual per capita share of water is estimated to decline from around 800 cubic metres per year in 2004 to less than 600 cubic metres per year in 2025, which will bring Egypt close to the extreme water poverty level (MWRI, 2005b).

Therefore, there is an urgent need to find a solution to close this increasing supply gap. However, a necessary prerequisite to reach an optimal solution for the water deficit problem is to determine whether the water deficit is a result only of a shortage in water resources or partially results from a problem of allocation of Egypt's current resources. The following sections examine the current allocation of the water resources and how it has been influenced by the Egyptian institutional environment.

3.2 Formal macro institutions

The Egyptian formal macro institutional framework witnessed gradual change during the 1990s that allowed the government to withdraw from its central role in the whole economic and social field. With regard to the water-sectors, the government pushed laws that established fees for the irrigation service under the slogan of farmer participation. In the social sector, it resorted to a silent withdrawal through gradual cuts in the annual budget allocations.

With regard to the water and agriculture sectors, two laws were issued during the 1990s. The first was the Law no. 4 of 1994, which regulated the environment in general and included specific regulation of water quality. The law

added another entity to those dealing with water, the Ministry of the Environment. However, the law did not make a clear distinction between the responsibilities of the Ministry of Water and that of the Ministry of Water Resources and Irrigation (MWRI, 2005a). The second law was Law no. 213 of 1994 which was meant to organise farmer participation in the management of the agricultural sector and irrigation to improve irrigation systems (MWRI, 2005a). The law established more cost recovery mechanisms for the maintenance of the irrigation and drainage system. It represented another step in the gradual withdrawal of government from its traditional responsibility of maintaining and managing the irrigation system.

Starting from the beginning of the 1990s, the government adopted a gradualist approach not only on subsidies reform but on the whole economic reform policy (Gutner, 1999). Therefore, the regime resorted to gradual institutional changes: political and economic. The gradual reform relied in modest gradual cuts, in real terms, in the annual social sector budget without any publicity (Tadros, 2006). The food subsidy was reduced from 14% of public expenditure in 1981/2 to 5.6% in 1996/7 (World Bank, 2010). On the other hand, although the budget for pre-university education experienced a nominal increase in the period from 1981 to the 1990s, it witnessed a steady decrease, in real terms, in the same period, which resulted in a continuous decrease in real public spending per student during this period (El Baradei & El Baradei, 2004). In another related institutional change, the government gradually stopped providing public employment for all university graduates. A similar decline has been reported in the total real health care spending which was estimated decline from around 5% of GDP to 3.7% of GDP in 1994/95 (Rannan-Eliya, et al., 2000).

3.2.1 Micro Institutional Structure

3.2.1.1 Agriculture and Irrigation

As indicated above, various laws were enacted during the 1980s and 1990s to regulate the various dimensions of water resources instead of a single comprehensive law regulating water resources. As a result, water management has

become fragmented among various ministries and public entities that either directly or indirectly contribute to water resources management (MWRI, 2005a). Eight ministries are directly or indirectly involved in the management of the Nile water. First, the Ministry of Water Resources and Irrigation (MWRI) has been the main authority responsible for authorising water use and managing national water resources, the irrigation and drainage systems. It is also responsible for ensuring reliable quantity and quality of drinking water. Efforts to expand Egypt's irrigation system succeeded in extending the irrigation network for 1200 kilometres from Aswan to the Mediterranean Sea. This network comprises 31,000 kilometres of public canals and 17,000 kilometres of public drains operated and maintained by the MWRI (Doss & Milne, 2005). Second, the responsibilities of the Ministry of Agriculture and Land Reclamation (MALR) including water management at the-farm level (MWRI, 2005b). Moreover, it is in charge of setting policies that aim to achieve an acceptable level of food self-sufficiency (Attia, 2004). Third, the Ministry of Housing, Utilities and New Settlements (MHUNS) is responsible for providing domestic water and sanitation services to the municipal and industrial sectors (MWRI, 2005b). Fourth, the Ministry of Health and Population (MHP) has the responsibility of sustaining the quality level of water resources, including the control of water pollution (Attia, 2004). Fifth, the Ministry of Local Development (MLD) is responsible for expanding water-related infrastructure, including the drinking water and sanitation infrastructure. Sixth, the Ministry of Industry is in charge of industrial wastewater drainage and monitoring of wastewater treatment units in industrial plants (Attia, 2004). Seventh, the Ministry of Electricity supervises the hydroelectric power subsector, which represents the third largest energy sector in Egypt (Attia, 2004). Finally, the Ministry of Transport is in charge of regulating river transportation and its safety conditions and monitoring its effects on Nile water quality (Attia, 2004). The dispersion of responsibilities has led to conflict of interests and powers among the different ministries which has reflected negatively on the management of the water resources in Egypt. Moreover, the redundancy of regulation has led to the absence of a credible regulatory framework for water-based activities. Furthermore, since the sector is highly sensitive and politicised, the government has kept domestic water supply at very low prices. As result, the water

and sanitation sector in Egypt fell to a low-level equilibrium in terms of low prices; low service quality and operational inefficiency. Sanitation has worse conditions since it has suffered from the same problems of the domestic water sector as well as limited service expansion due to insufficient availability of public finance.

3.2.1.2 Social Sector

Food subsidies have been subject to a gradual reduction in the budget. The Ministry of Trade and Supply resorted to different strategies to implement this reduction without any opposition, such as by gradually reducing the quantity of the particular subsidised good, gradually replacing one brand by a more expensive one and reducing the number of subsidised items from time to time (World Bank, 2010). An example of this is the MOTS strategy of increasing the price of the bread various times without opposition. This strategy was based mainly on the introduction of higher quality, higher price loaves alongside the existing cheaper loaves, which then disappeared after a few months (Gutner, 1999). Moreover, in the case of subsidised bread, the deformation of the food staples market yielded another negative development because of the agency problem that resulted from the nature of private bakeries as multi-product producers. Most of the private bakeries diverted subsidised flour into the production of non-subsidised items (World Bank, 2010). Although this was prohibited by the government, growing corruption led to the inefficiency of the government monitoring system (Gutner, 1999). This corruption has grown since 1990s as a result of the deterioration of the salaries paid to civil servants because of the structural adjustment programme adopted by the government in 1991. Therefore, bread increased in price while deteriorating in quality and quantity.

With regard to education, as education is characterised by human asset specificity, the MOE has concentrated most of its budget on the salaries of teachers, which has put pressure on the infrastructure. Moreover, demand has gradually risen to exceed the available state resources. Thus, many schools began to operate in shifts and to hire unqualified teachers. This resulted in a deterioration in the quality of public education (Loveluck, 2012). Moreover, the deterioration of the salaries of

teachers led to the multi-task agency problem that exacerbated the education problem. Although the government permitted the private education sector to grow to reduce the pressure on the public system, the poor teacher-student ratio persisted (Tadros, 2006). Teachers began to conduct private paid tutoring to compensate their low salaries (Bayat, 2009). This compounded the problem of the quality of education as teachers tended to spend less effort in classes. This poor quality of state-provided schooling forced the students' families to resort to private tutoring to fill the educational gaps left by the formal schooling system (Loveluck, 2012). Although the MOE has declared frequently that this private tutoring was prohibited, the prohibition has never been materialised in concrete effective measures.

In the health care, public health care services have gradually been provided by fees. One important feature of the change process is the lack of sufficient concern with equity as a main policy goal in the health sector. The distributional consequences of government health policies were not given a high priority (Rannan-Eliya, et al., 2000). Based on the recommendation of the World Bank, Egypt gradually introduced user fees for both outpatients and in-patients in selected general and central hospitals to fill the budgetary gap (Tadros, 2006). Although there is a mechanism (called commission) for exempting poor from the fees, the required documentation and the complexity of the administrative procedures has rendered it inefficient and increased vulnerability to clientelism in public facilities. Moreover, since the health care sector has been characterised by human and technological asset specificity, these two types of assets have consumed the majority of the budget. Therefore, public hospitals resorted to requesting patients to bring the necessary medical supplies for their treatments and stopped providing free medicine to poor patients (Tadros, 2006). Like the education sector, health care sector has suffered from the multi-tasking agency problem, but the difference is that multiple job-holding and private practices are allowed by law. In an empirical study done in cooperation with the MOH, Berman (1999) found that 89% of the sample practised multiple jobs. Although public employment offers relatively low salaries, it has become a tool for obtaining experience, building up a patient list and reputation (Berman, 1999). The result of these compounding problems is that healthcare

system has been gradually privatised.

3.3 Individual Level

Successive governments have given priority to the establishment of drinking water infrastructure, but the rural population lacks sufficient sanitation systems. Piped water supply has reached 97% of the urban population and 70% of the rural population of Egypt (MWRI, 2005b). Almost all major cities in Egypt enjoy drinking water coverage. However, it should be noted that surface water quality deteriorates as one goes downstream with the worst pollution occurring in the northern parts of Egypt as a result of recycled water being discharged into the Nile (MWRI, 2005b). The negative effect of this pollution was reflected not only in quality of drinking water and agricultural crops but also in fish production. Although fish production has grown over the last few decades in Egypt, only 17 species remained as of 1995, out of 47 species which used to be available in 1948 (MWRI, 2005b). Therefore, the deterioration of the quality of water was not only reflected in the quality of drinking water but also in the quality of food available to citizens. On the other hand, sanitation services still lag behind water supply, especially in rural zones. Only approximately 52% of the urban population is covered by sanitation systems while around 11% of the rural population is connected to the sanitation systems (MWRI, 2005b).

With regard to agriculture and irrigation, the area of cultivated land is still limited, around 7.5 million *feddans* or about 3% of Egypt's total land. However, the agricultural sector still accounts for around 20% of GDP and still represents the main activity for a large sector of the population as it employed 37% of the workforce in 2000 (Doss & Milne, 2005). However, public spending on the quality and management of irrigation network has declined to around 4% of the total public recurrent expenditures (MWRI, 2005b). Furthermore, on the investment side, average public spending on national irrigation infrastructure and water-resources related programs declined from over 50% of average annual public investments in the first half of the twentieth century to 15% by 2005 (MWRI, 2005b). This has been reflected in the declining incomes of the farmers and their living conditions. Since

the late 1980s, many reforms have attempted to deregulate agricultural sector by liberalising input and output prices and removing crop area controls. Moreover, this liberalisation was not accompanied by a parallel reform in the Egyptian bureaucracy. Therefore, the irrigation system is slow and bureaucratic, which makes the livelihood of farmers more difficult (Doss & Milne, 2005). Moreover, it is argued that small landholdings, which resulted from the agrarian reform of 1950s and 1960s, restrict the capacity of the agricultural sector to use modern technology and techniques. Therefore, although Egypt began new agricultural development projects since the 1990s to expand the cultivatable area by 3.4 million *feddan*s, most of the projects implemented were allocated to major land development companies (Doss & Milne, 2005). This has meant that while small farmers face severe competition in their small traditional landholdings, they have not benefited from the new expansion in the agricultural lands. Therefore, the incomes of small farmers have declined during the last two decades.

The Egyptian economy witnessed a significant growth during the first decade of the twenty-first century, relying mainly on foreign direct investment (FDI). As a result of a series of reforms, Egypt was able to increase its inflows of FDI to unprecedented levels during the first decade of this century and to become the second FDI recipient country, after Turkey, in the Middle East and North Africa (MENA) Region. Egypt achieved annual inflows above 10 billion dollars in the period 2006–2008 and maintained annual inflows above 7 billion even after the international financial crisis. Moreover, Egypt has achieved an increasing economic growth that reached around 7% at 2008 and maintained a growth rate above 4% after the international crisis. Nevertheless, tracking the poverty trends in the above-mentioned period, one can recognise that the poverty rate increased from 17% of the population in 2002 (10.7 million persons) to 21.6% (18 million persons) in 2009. This increasing inequality and poverty has been identified as one of the main reasons behind the Egyptian uprising in 2011 in spite of the successful economic growth of the country. Moreover, the main beneficiaries of this economic growth were the capitalist elite class followed by urban middle classes. The integration of Egypt in the Common Market for East Africa (COMESA) in the second half of the

1990s catalysed an increase in employment in non-agriculture sectors at the expense of employment in agriculture (Zaki, 2014). Egyptian exports of non-agricultural products were more competitive in African markets in comparison with agricultural product which faced fierce competition from African agriculture exports even at home. This has resulted in a decrease in output and employment in the agriculture sector (Zaki, 2014). The severe working conditions of the agriculture sector and relatively low wages has led to a decrease in employment in agriculture to around 28% of GDP by 2006 (Zaki, 2014). As a result, the gap between rural workers and the urban working classes has widened. As Zaki states, "Given the fact that the majority of rural individuals are working in the agriculture sector where Egypt does not have a comparative advantage, once trade is opened, farmers should be negatively affected, which increases the gap between rural and urban workers" (Zaki, 2014, p. 57).

With regard to social services, the public social expenditure has been characterised by different patterns of bias in favour of the higher and middle income classes. Firstly, the food subsidy system, especially for bread, favoured urban areas over rural areas. While urban areas, especially Cairo, have been receiving a subsidy share much higher than their share of the population, all rural areas, especially governorates in Upper Egypt that have larger shares of poor people, have received much less than their population shares (World Bank, 2010). For example, two out of every three households purchase subsidised bread in urban areas, which is a higher proportion than in rural areas (World Food Programme, 2005).This is reflected in the distribution of the subsidised bread bakeries over the country. In 1997, 71% of bakeries making subsidised bread were located in urban areas. Moreover, these bakeries received 82% of the total subsidised wheat flour. Moreover, while the MOTS decreased the subsidised goods received allocated by the ration cards, which is relatively geographically allocated, from drastically from 18 to 5 items, the bread subsidy was subject to much lesser reduction (Adams, 2000). Therefore, the incidence of negative consequences of food subsidy reduction was higher on the poor rural population.

Furthermore, the poor have suffered from the poor quality of education and

dependence on private tutors. Private tutoring absorbed more than 25% of annual earnings of Egyptian families in 2000 (Bayat, 2009). Moreover, it absorbed a higher proportion of the total spending on education of the poor (59.96%) and middle class (53.4%) (Loveluck, 2012). Therefore, the burden on the poor was higher than on the middle class. In many cases, families have had to sell household goods, reduce their health care expenditure or even stop schooling some of their children to afford the costs of education of the other children (Tadros, 2006). Moreover, the decline of the quality of public education, including university education, led to a mismatch between education outputs and employment opportunities in the market (Loveluck, 2012).

Similarly, the lower classes have suffered from growing inequalities in the health care sector. These inequalities resulted from the bias of public policies in favour of the upper and middle classes. A significant share of public health spending has been channelled to large programmes which have benefited mainly the urban populations and formal sector employees (Rannan-Eliya, et al., 2000). For instance, university hospitals, one of the major recipients of public funding, became mainly located in central urban zones. Moreover, these hospitals charge modest fees that discourage or prevent poorer people and rural residents from benefiting from their services (Rannan-Eliya, et al., 2000). Social insurance programmes have proved to be a regressive mechanism for funding health services because of the large rural population and informal sector workers (Rannan-Eliya, et al., 2000). Moreover, the extra informal costs (medical supplies, clientelism and compulsory illegal referral to private practices) affected negatively the propensity for the poor to resort to public health services that was reflected in lower utilisation rates of most public services by lower income groups (Tadros, 2006). In 1999 the out of pocket expenditure represented 49.6% of the total expenditures on health care in Egypt, which is the highest among other Arab countries (Galal, 2003). Although there is no available data for the same ratio for the poorest groups, it is expected to be higher than the overall ratio as a result of their lower income.

As a result, Egyptian society has suffered from increasing inequality that intensified the social stratification. The gap between the three main social classes

has widened, and even the gap between the different layers within the same class became wider. The first class includes the ruling elite who control the majority of wealth sources not only in the industrial sector but also in the agriculture sector. This class gained control over large areas in the newly reclaimed land projects, which became the main sources of exports of agricultural products. This class continued to enjoy high-quality private social services which enhanced their capabilities. Therefore, individuals who belong to this class are healthy and sufficiently nourished, well-educated, properly prepared for the job market, and having access to adequate health care services. The second class include different layers of the middle class that have had, with different degrees, access to public social subsidies and services. It should be noted that the quality of the social services available to this class is not guaranteed and may not guarantee them the basic capabilities; that is, being sufficiently nourished, having access to the centralised supply of drinking water, adequately educated to be equipped with the necessary skills for employment market and having access a proper health care services. The upper layer of this class has a better chance to attain sufficient basic capabilities that allow them to enjoy good and acceptable life while the lower layers may have not sufficient access to acceptable social services and may not attain acceptable basic capabilities. Thirdly, a gap has evolved between the urban and rural groups within the poor class. Poor urban groups hardly have access to affordable nutrition but they have access to the centralised supply of drinking water. However, they may not be able to afford the costs of acceptable services of education and health. On the other hand, this poor rural group lacks access to almost all sufficient basic capabilities, except subsistence nutrition. They lack access to sufficiently waged employment, health care services or even basic education. This meant that the burden of the withdrawal of state was assumed mainly by the poor classes, and mainly poor rural groups. In an empirical study carried out in 2006–2008 in two of the poorest Egyptian rural areas to evaluate the effect of the public policies on the poor classes, Ibrahim (2011) found that poor people were not able to achieve their aspired basic capabilities. Almost two-thirds of the respondents asserted that they were not able to gain sufficient income for their livelihood. About 80% of the sample mentioned that they failed to achieve their educational objectives; 61% of the youth surveyed

stated that they were employed, but only half of them were satisfied with their work. Finally, about 56% of respondents reported that they did not have, or had limited, access to health services. Furthermore, about 65% of respondents who had health problems complained of not having access to adequate health care services. Finally, this class of population had limited access to centralised water supply while most of them lacked access to sanitation services. Ironically, the social class having the most extensive interaction with the Nile was the one that received the least benefit from this social change.

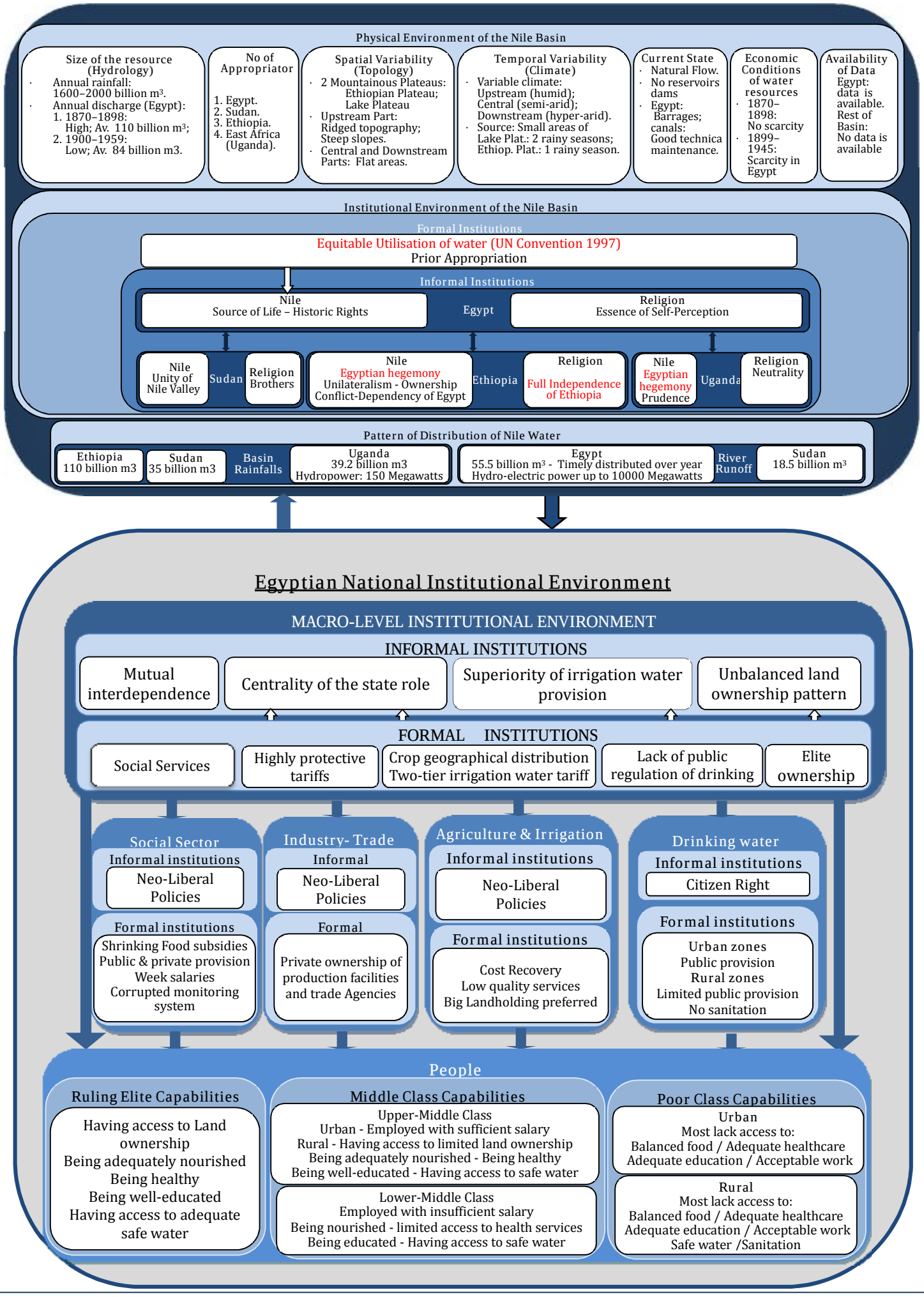


Diagram 8-5: Institutional structure of the Nile Basin – Egyptian Institutional Environment

4 Current Situation and Reflections for the Future

4.1 Current Deadlock

The current hydropolitical deadlock in the Nile Basin requires a joint effort from all riparian countries to develop new ways to manage the Nile resources in a manner that can accommodate the conditions of all the riparian countries. There are four possible future scenarios for the development of the current impasse in the Nile Basin.

The first scenario is the ratification of the Cooperative Framework Agreement (CFA) by six signatory countries instead of the opposition of Egypt and Sudan. This scenario has four main challenges. Firstly, a ratified CFA without Egypt and Sudan would fail to achieve its main goal. The main reason that motivated the upstream countries to participate in the negotiations of the CFA was to develop a legal framework that would allow them to resolve their conflicts with the downstream countries over the utilisation and division of the Nile water (Kimenyi & Mbaku, 2015). If the CFA entered into force without Egypt and Sudan, it would be considered as unilateral action that would not be binding on Egypt and Sudan. Therefore, it would not make any positive contribution to resolve the pending issues among the upstream and downstream countries. Secondly, the division between the riparian countries over the CFA would discourage international donors and financial institutions from providing the necessary finance to Nile-related projects (Kimenyi & Mbaku, 2015). The disputed agreement would increase the risk of any future project. Therefore, the riparian countries would find increasing difficulty in accessing the international financial resources. Thirdly, there is a legal problem with the question of the succession of the Commission established by the CFA to the NBI. According to Article 30 of the CFA, "Upon the entry into force of this Framework the Commission shall succeed to all rights, obligations and assets of the Nile Basin Initiative (NBI)" (Appendix). The question is how the signatory countries to the CFA can replace the NBI by the Commission without the consent of two, or even one, founding members of the NBI, i.e., Egypt and Sudan. Last but not least, the reaction

of the downstream countries should be taken into consideration as they may resort to escalation of the situation by carrying out unilateral new water-use projects. In this case, the Nile Basin would experience the devastating scenario of the tragedy of the commons. Because of these difficulties, Bitsue (2012, p. 6) stresses that "any cooperative framework agreement that does not include both the upstream and downstream riparian countries as signatories, as is the case with the NBI's CFA, will not be a real and effective solution to the long-standing competition over the Nile waters".

The second scenario is to maintain the present situation, i.e., freezing the CFA by not completing the number of ratifications required for the entry into force of the Framework. This scenario is sought by the downstream countries to maintain the status quo. Although Egypt and Sudan were the countries that initiated the negotiations process that led to the draft signed by the upstream countries, this process led to results that were not accepted by them. Therefore, it would be better for them to maintain the current status until a better understanding can be reached with upstream countries. However, this scenario would face the challenge of the implementation of unilateral water projects by one of the upstream countries as Ethiopia did with its Renaissance Dam. Although Egypt is attempting to control the conflict with Ethiopia, the repetition of such attempts would not only complicate any future negotiations for water sharing in the Nile Basin but also could trigger also a tragedy of the commons scenario in the Basin.

The third scenario would be the accession of Egypt and Sudan to the CFA after reaching a compromise over the conflicting articles in the CFA. However, this scenario would not lead to a stable situation as this study and the reality reveal that historical factors have played a decisive role in hindering the cooperation among parties in the past. The latest movements and positions adopted by the riparian countries reveal the deepness of these cultural and historical beliefs. For example, the first thing that Ethiopia's late Prime Minister, Meles Zenawi, did after the signature of the CFA was to emphasise in a public statement the sovereign right of Ethiopia to the Blue Nile water and to assert that Egyptians should give up their old-fashioned ideas that assume the Nile water belongs to Egypt (Swain 1997, 2008). On

the other hand, Egypt has reacted by integrating an article in its new constitution adopted in 2014 that obligates the Egyptian president to protect the historical Egyptian rights to the Nile water. Therefore, even the accession of Egypt and Sudan may represent a breakthrough in the short run but it would not represent a sustainable long term solution for the historical conflicts among the main riparian countries.

It is clear that neither of the above three scenarios would change the present state of conflict between the downstream countries led by Egypt and upstream countries led by Ethiopia. Therefore, even the third scenario which entail the accession of Egypt and Sudan to the CFA would at best break the current deadlock but would not lead to a sustainable settlement to the prolonged conflict between downstream countries and upstream countries.

4.2 The Road Ahead

As indicated in this study the hydrological relations among riparian countries are complicated and multidimensional. Therefore, it is important to identify a roadmap that can guide the efforts of the riparian countries to develop a conducive environment to cooperation among them. The first step in the roadmap is to identify the economic challenges and problems that need to be addressed by the riparian countries. Consequently, mechanisms of cooperation to overcome these challenges should be specified. Last but not least, reform must start at home. Therefore each country should improve its domestic water policies to increase its efficiency and guarantee that it enhances the capabilities of the population not limited to a certain segment of the society.

4.2.1 Current Challenges

There are four pressing challenges that threaten the future of cooperation countries of the Nile Basin. The first is the negative role played by non-economic factors, which have been modelled in this study as informal institutions, in hindering cooperation among riparian countries. Second poverty and rapid population growth

have put increasing pressure on the economic resources of the riparian countries, including water. Thirdly, there are expected negative impacts from climate change on the waterfalls and the Nile water. Finally, the increasing economic interests of outsider parties in the resources of the Nile Basin, especially agricultural production, are a source of pressure.

Although the Nile water-sharing question is an economic problem, there have been non-economic factors or informal institutions that have influenced negatively these relations in the Nile Basin. Although informal institutions have played a positive role in some instances, they have constrained, in most of the cases, the development of relations among the Nile riparian countries. The long history of conflictive interactions between the two dominant riparian states has been dominated by the conflict of their informal institutions of ownership of the Nile. Moreover, the hegemony of Egypt over the Nile water is another negative informal institution that has evolved during the last thirty year. These negative informal institutions are partially responsible for the present deadlock in the Nile Basin. To the contrary, the brotherly informal institutions inherited from the common history of Egypt and Sudan contributed positively to their success in resolving their differences and developing a common position in the Nile Basin. The severity of the challenge raised by informal institutions stem from the fact that informal institutions are persistent and slow to change.

Persistent poverty combined with population growth has increased the economic pressure on the Nile riparian countries. With the exception of Egypt, whose Gross National Product (GNP) was PPP $5,260 in 2012, the rest of the Nile riparian countries have GNP below the PPP$1,966 average for Africa (NBI, 2012). Moreover, the total population of Nile riparian countries was 447 million people in 2012, 54% of whom (238 million) reside in the Nile Basin (NBI, 2012). Furthermore, the population of Nile riparian countries is projected to reach 726 million people by 2025. The spatial distribution of population in the basin is influenced by water availability. Therefore, in downstream countries population is mainly concentrated along the course of the Nile, while it follows the pattern of rainfall distribution in the upstream countries (NBI, 2012). This population distribution has had two results.

First, as agriculture is the main means of livelihood of the majority of the population, the agricultural sector accounts for 75% of total water withdrawal in the Nile Basin (Swain, 2011). In Egypt and Ethiopia, the agricultural sector is responsible for 86% of water withdrawal, while in Sudan it accounts for 94% of water withdrawal (Swain, 2011). Second, the majority of the population resides in rural areas. In general, 72% of the basin population lives in rural zones (NBI, 2012). This dominant trend of the rural population is expected to persist until 2050 in the Nile riparian countries, with the exception of Egypt, Sudan, the Democratic Republic of Congo and Tanzania (NBI, 2012). Furthermore, owing to past policy neglect of rural zones as we have seen in the case of Egypt, the incidence of poverty and undernourishment is higher in rural zones than in urban zones (NBI, 2012).

The second challenge that the riparian countries face is the potentially negative effects of climate change. Climate change represents a double challenge to the Nile Basin. On one the hand, the basin is highly vulnerable to the negative consequences of climate change. On the other, the basin countries have limited ability to adapt to these negative consequences. The vulnerability of the basin is related to the high sensitivity of the main economic sector in the basin, such as agriculture and livestock production, to the probable impacts of global warming. Global warming is predicted to increase the frequency of extreme events in the Nile Basin, such as droughts and floods (Swain, 2011). Moreover, the basin may receive increased rainfall early in the first half of the current century, followed by decreases later in the century (Swain, 2011). As a result, the annual average Nile River runoff is projected to experience an increase from 11% to 14% in the first half of this century then followed by a decrease 7 to 16% in the second half of the century (Swain, 2011). Although the exact effects of climate change on the basin have not been accurately confirmed, it has been reported that the rainy seasons have become shorter and more intense in the last few years (NBI, 2012). These changes are predicted to threaten agriculture, livestock production and fisheries. Furthermore, the predicted rise in the level of the Mediterranean Sea is expected to threaten the very productive Nile Delta in Egypt (NBI, 2012). This significant challenge needs from the basin countries to work collectively to enhance their adaptive capacity to

such a significant future danger.

The third threat to the Nile Basin countries is the increasing trend among the international and regional powers to intervene in the Nile Basin with the aim of extracting the benefits of the Basin for their own interests. The most striking type of intervention is the land grabbing by affluent foreign governments and multinational corporations (Yassin, et al., 2013). Countries in the Nile Basin that suffer from the lack of cultivable land and appropriate climate for agriculture invest in land acquisition with the aim of increasing the yield for consumption back at home. It has been reported that states like the Gulf countries, especially Saudi Arabia, Libya, China, India, Pakistan and South Korea have been purchasing large areas of cultivable lands in the Nile Basin (Yassin, et al., 2013). This phenomenon of land acquisition by foreign states reduces the food output available for domestic use in riparian states and threatens to increase the chances of local famine in the riparian countries (Yassin, et al., 2013). Moreover, it increases the inter-riparian states competition over water to increase their food output to compensate for the food production extracted by these foreign states. Although agricultural land acquisition by the downstream countries in order to import agriculture production from upstream countries was recommended to strengthen the mutual cooperation among the riparian countries, only Egypt has recently signed some agreements to establish joint farms in the upstream countries but these projects have not succeeded.

4.2.2 Addressing Challenges

4.2.2.1 Setting the Stage for Cooperation

A prerequisite to build sustainable cooperation is levelling the playing field by addressing the informal institutions that are prohibitive to cooperation. Collaboration between riparian countries should be a continuous process that deals with the socio-economic challenges in the Nile Basin (Bitsue, 2012). Tackling the problem of the conflict, informal institutions among peoples of the Nile Basin will facilitate the work of negotiators and representatives of riparian countries in the strategic interactions between them. Since informal institutions are persistent and

slow to change, a good strategy to deal with them is to attempt to attenuate their negative effect while working on changing them gradually over time. Informal institutions are a cultural problem that has economic roots (North, 1990). Therefore, it needs to be addressed through various channels of cultural and economic exchange, such as the media and education as well as economic cooperation.

Media and communication could serve as a fast track strategy to weaken the negative impact of the historical impediments. Governments should encourage the different types of media to highlight the development needs of riparian countries. All riparian countries suffer from poverty to different degrees. Cooperation among riparian countries provides the Nile countries with huge opportunities for development, especially in agriculture and hydropower generation. It is also important that the peoples of the Nile Basin get to know about their common problems and to learn about the potential achievements in case of cooperation. "The promotion of broad public awareness is an essential part of basin-wide cooperative efforts to strengthen attitudes, values and actions compatible with the sustainable use and development of the Nile waters." (Bitsue, 2012, p. 10).

The second avenue to address informal institutions is education. Education can establish a solid base for cooperation among riparian countries by providing younger generations with the facts about the links between riparian nations and correcting inherited misconceptions. Educational cooperation can also permit joint research projects that explore the potential for cooperation among riparian countries. Moreover, highlighting the common realities of the Nile Basin countries and the benefits of their cooperation will forge the political will of the riparian countries to act (Bitsue, 2012).

Another important avenue is economic cooperation outside the field of water. Economic exchange is not only important to build common interests among the riparian countries, but it also has been the oldest means of cultural interactions. All Nile riparian countries are members of COMESA, which aims to establish a common market among the East African countries. However, although COMESA has achieved some progress in promoting trade among East African countries, it suffer from the

problem of having non-riparian countries as members in this regional organisation, some of them are influential such as South Africa. Therefore, the interactions within COMESA and its results are affected by other factors that are not related to the relations among the Nile countries, such as the competition between major regional economic powers such as Egypt, Kenya and South Africa. Thus it is recommended to study the possibility of a smaller economic organisation that is restricted to Nile riparian countries. This organisation might deal with economic and trade cooperation in general or be limited to certain priority sectors that have potential for cooperation among riparian countries to avoid any potential conflict among them. At a later stage this economic cooperation may led to a degree of economic integration. Economic integration between upstream and downstream countries would enable them to give up gradually the individual state-centric approaches to water resource governance that led to the uncoordinated management of the Nile water (Bitsue, 2012).

4.2.2.2 Establishing an Effective Cooperation Mechanism

With regard to water-specific cooperation, the riparian countries need to adopt a gradual approach. Complex water sharing issues should be deferred to later stages. Early stages should be devoted to dialogue on national needs and priorities and how to reconcile them. Consequently, riparian countries should seek opportunities for mutually beneficial programmes or projects. These projects should take into consideration both the development needs of the upstream countries and the concerns of downstream countries to avoid the exacerbation of the existing conflicts and to facilitate future cooperation (Bitsue, 2012). Riparian countries should cooperate to standardise and harmonise their laws and regulations that govern water use (Waterbury, 1997b). This would facilitate decisions on the optimal use of water in the Nile Basin. Finally, when riparian states are ready to move to water sharing negotiations, they need to tackle issues cautiously starting with the achievable and deferring the conflictive issues to later stages. These negotiations should balance between the economic and non-economic considerations. Although economic logic implies that highest economic returns per unit of water determine

that the party receives additional units of water (Waterbury, 1997b), social dimensions and informal institutions should be taken into consideration.

This strategy of cooperation requires a formal mechanism that can enable dialogue and cooperation among riparian countries (Hassan & Al Rasheedy, 2007). Unfortunately, the NBI is a transitional institutional mechanism for the Nile Basin countries which aimed to develop a Cooperative Framework Agreement (CFA) that would create a permanent river basin organisation. It lacks the institutional depth and substance necessary to play such an important role in future cooperation, which will include dialogue management, strategic planning and resource mobilisation (Belay, et al., 2010). The new cooperation mechanism should be supported by the international donors but also by the basin countries themselves.

4.2.2.3 Reform begins at home

Egypt has been facing a double challenge. Externally, although Egypt's share of Nile water is secured by the agreement signed by Egypt and Sudan in 1959, this share has been increasingly challenged by the upstream riparian countries. This challenge has been compounded by the fact that Egypt depends almost entirely on Nile water which represents 97% of its total renewable water resources (UNDP, 2006). Internally, the unprecedented population growth during the last decades has challenged Egypt's capacity to secure safe water for the different uses (MWRI, 2005b). Therefore, the Egyptian government needs to adopt a two-fold policy of supply improvement and demand management (Attia, 2004).

On the supply side, Egypt needs to reduce its almost full dependency on the Nile. Available alternative resources are rainfall harvesting and desalination (Attia, 2004). The success of Egypt in achieving a relatively balanced water supply would have various benefits. From an economic point of view, it would offer greater supply to meet its increasing demand for water. On the political side, it would give Egypt greater flexibility in inter-riparian negotiations. From an institutional perspective, it would gradually reduce the internal public fear and rigidity concerning the Nile water, rooted in the inherited Egyptian informal institution of conceiving the Nile as

the source of life of the Egyptian people. This would further enhance the flexibility of Egypt in any future negotiations. Moreover, it would end the attempts of any future regime to misuse the water question to gain popularity. As Waterbury (1997a, p. 295) indicated, "there is no issue that can arouse more popular fervour in Egypt than that of its water".

On the demand side, various studies have shown that significant water savings can be achieved by the adoption of demand management policies. However, since this study focuses on the role of institutional factors in water management, the recommendations presented will focus on the available option for water saving through improving the institutional environment The study revealed that the benefits of changes of the Nile Basin water allocation regime to the Egyptian population ware influenced by both the socio-economic institutional context and the micro organisational context of economic activity. Therefore, it can be deduced that reforming the existing imbalances in these contexts will have positive impacts on both the benefits accrued generally to the Egyptian population and on the distribution of these benefits across the various segments of population.

On the macro-institutional level, there is an urgent need for legislative reform aimed at increasing the efficiency of water use. This reform should enact a single unified law for water use among various sectors. However, this reform should differentiate between water as a human right and water as an economic good. Securing access to sufficient safe water as a human right was formalised by the United Nations Committee on Economic, Social and Cultural Rights in its "General Comment on the Right to Health" in 2000. Moreover, the right of access to safe water and sanitation was included in the development goals of the Millennium Declaration. Therefore, the new legislation should confirm the citizens' rights to have access to safe domestic water and sanitation. However, such a proposed regulation should deal with water in the sector as economic good. Therefore, water should be treated as an economic resource with prices based on supply and demand as well as the development priorities of the country (Doss & Milne, 2005). Cost recovery of water resources services for economic sectors will allow the government to improve the quality of these services and improve the water quality (MWRI, 2005b). The burden

of the current water price subsidy for both industrial and agricultural use, especially for newly reclaimed land, is assumed mainly by the middle and poor classes for the benefit of major land owners and capitalist classes. Therefore, removing, or at least reducing, this subsidy will remove a significant imbalance in the distributive policy of Egypt. Another important institutional reform should be carried out in the legislation that regulates the social sector of Egypt. This reform should ensure the balance between the allocation of social support to the rural and urban zones. The current situation implies that the people who produce the majority of Egypt's food receive the lowest share of food subsidy and other social benefits.

On the micro-organisational level, two main recommendations can be presented: the unification of the water management body and the adoption of participatory water planning and management approach. As explained above, water management is fragmented among various ministries and governmental bodies with no efficient mechanism to avoid conflicts and guarantee coordination among them. Having a single governmental body responsible for water management under a unified water regulation would enhance water management in Egypt. Combined with this reform, it is important to adopt a participatory water management approach. If the majority of planning and management of a water resources project is feasible at the lowest geographical or community level, it should be carried out on the local level (Waterbury, 1997b). Only those water questions which the local actors lack the finances or the expertise to implement it should be raised to the higher level (Waterbury, 1997b).

In summary, there is a possibility for water saving and improving efficiency in water policy management if appropriate reforms are carried out on both the legislative and organisational levels. A strong state is the state that can deliver entitlements such as water and food, to its population because of the strength of its institutional environment and governance organisational structure (Allan, 1999). Finally, it should be noted that the ideas presented here are reflections based on the analysis of the past history and the current state of the Nile. Some of these recommendation could be further explored by future studies. An important area to be explored in future studies is the relation between the potential impact of

reforming the Egyptian water sector and the future needs of Egypt of the Nile water, which in turn will influence the future of relations among Nile Basin countries.

5 Conclusions

This chapter analysed the last phase of the inter-riparian strategic interaction which led to the current hydropolitical deadlock. This phase witnessed an attempt to establish a basin-wide cooperation mechanism induced by the conclusion of the United Nation Convention on the Law of the Non-navigational Uses of International Watercourses in 1997. Although the convention was not ratified until 2014, its conclusion represented a major step towards a change in the international institutional environment governing watercourses. Therefore, riparian countries were encouraged to embark on this joint work to be in line with the expected changes in the international institutional environment. After various attempts to develop basin-wide cooperation mechanisms, riparian countries developed the NBI as a transit mechanism leading to a framework agreement on the management of Nile water.

However, this attempt has not achieved its goal because riparian countries failed to achieve consensus over the final draft of the Common Framework Agreement (CFA). Informal institutions were among the main determinants of positions of riparian countries in the negotiations that led to this impasse. The deep-rooted conflict of informal institutions between Egypt and Ethiopia over the Nile water ownership played a decisive role in shaping their position. Moreover, the informal institution of the Egyptian hegemony over the Nile shaped the position of Uganda that took a position for the first time not only against Egypt but also one that does not serve optimally its interest. On the other hand, the historical informal institution of brotherhood between Egypt and Sudan helped them to reconcile their difference and take a common position opposing the proposed draft of the CFA. Unfortunately, these positions led to the collapse of negotiations and the failure of riparian countries to change the status quo.

On the national Egyptian level, although the water supply of Egypt did not change during this phase, the distribution of benefits of the Nile water has witnessed significant changes. The neo-liberal policies adopted by the Egyptian regime have led to an intensive stratification in the Egyptian society. The upper class maintained its high capabilities and entitlements while the lower, especially rural, classes experienced an erosion of their entitlements and capabilities. This was a direct result of the neo-liberal changes in the

national institutional environment and the inefficiencies of the micro-organisational structures of the Egyptian government. The fragmentation of water management among various bodies and deformed water pricing policies led to a deterioration of the quality and coverage of water services. The social sector also suffered from an agency problem and weak incentives policy that led to the decline in the entitlement of the medium and lower classes. Therefore, although the water share did not change during this phase, the Egyptian institutional environment contributed to a significant segment of citizens not enjoying of the benefits from the Nile water.

In the light of the above analysis, some reflections and recommendations for the future are presented. On the basin level, a gradual approach to deal with inherited informal institutions is recommended. Similarly, on the cooperation track, it is proposed to move gradually from dialogue to joint projects to develop a context conducive to future negotiations over the conflictive water sharing question. In the Egyptian arena, regulatory reform is suggested to guarantee people access to safe water and sanitation while providing water to economic sectors on an economic basis. Furthermore, an organisational reform is necessary to unify the responsibility for water management under a single ministry or other entity. The gradual movement to a participatory approach to water management in Egypt is necessary. Finally, further investigation of the mutual interdependence between the basin-level institutional framework of the Nile and the regulatory framework of the water-using sectors in Egypt is recommended for future research.

CHAPTER 9

CONCLUSIONS

This study aimed at understanding of the evolution of Nile Basin management regime during the period 1882-2014 and its impact on the livelihood of the Egyptian people. A more specific concern has been the assessment of the role of institutions on the cooperation among the beneficiaries of a river basin and on shaping the benefits received by the Egyptian population. Moreover, the research set out a parallel objective of contributing to the theoretical literature on transboundary resources management by introducing a framework that can investigates the interaction between cross-border water management and riparian countries' regulation of the national shares of this water. Therefore two distinctive features has distinguished this research: the research analytical method and the study finding and conclusions.

1 Research analytical Method

Since the problem of transboundary water resources management is multi-faceted and complicated, the research developed a multi-level analytical framework that has the analytical capacity to deal with the complex problem. The research used a merged framework to analyse the dynamics of the institutional settings that has governed the Nile basin and its impacts on the Egyptian population. The merged frameworks integrated the new institutional economics and the capability approach to provide an analytical framework that can analyse the two-level institutional change in the Nile Basin: the basin-wide transboundary level and the Egyptian national Level.

On the transboundary level, the game-theory based institutional framework of Elinor Ostrom proved to be an analytical tool that has the capacity to analyse the evolution of the Nile management regime. It enabled the study to reveal the dynamics of the strategic interactions among riparian countries. On one hand, the game theatrical foundation of Ostrom's framework allowed us to analyse multi-state interactions where each one of them has its own objectives and decision criteria. On the other, the institutional perspective of her framework identified the limits of that

bounded the rationality of the decision makers and shaped their decisions in these interactions. Furthermore, the same institutional analysis enabled the research to trace the interactions between the changes in the formal regulative regime of the Nile basin resulting from these interactions and the informal normative governance regime that evolved over the history of the Nile. It revealed the resistance of this informal normative regime to the formal changes yielded by these inter-state strategic interactions.

On the Egyptian national level, the multi-level institutional framework allowed the research to trace the impact of the changes in the basin-wide governance regime on individual well-being in Egypt. The macro-level institutional environment Douglass North analysed how the Egyptian national legislation on interpreted the basin-wide rules into national regulations organising the water-related economic activities. Moreover, the micro-level governance institutional structure analysed how the Egyptian governmental entities influenced the diffusion the benefits of these basin-wide and national regulations changes to people. Finally, the capability approach traced the benefits that accrued to the different segments of the society and how it affected, whether enhanced or limited, their capabilities to improve their livelihoods.

2 Study Findings

The study analysed the role of institutions in the evolution of the Nile basin management and its impact on the Egyptian population during the period 1882-2014. A more specific concern was identifying the influence of informal institutions on this two-level regime evolution. The study period was divided into three main historical phases or sub-periods: the colonial period, the post-colonial period and the basin-wide cooperation period. The analysis of these three sub-periods revealed that informal institutions played an important role in the Nile basin. First, informal institutions has been a key determinant of the outcomes of the cooperation attempts among riparian countries during the study period. Second, it influenced the benefits accrued to the Egyptian population from the changes in the Nile basin governance regime.

2.1 Informal institutions & inter-riparian cooperation

In general, the examination of the cooperation history among riparian demonstrated that the informal institutions of riparian countries have hindered the cooperation attempts during the study period from achieving their optimal outcomes. However, it should be noted that although the role of informal institutions has been mostly negative, it has had positive impact in some instances.

On the negative side, informal institutions has been a major obstacle between Egypt and Ethiopia through their common history. The conflict over the Nile ownership and the religious confrontation have shaped the historical Ethio-Egyptian relations. This conflictive heritage has impeded their endeavours to collaborate to maximise their benefits from the Nile water. Although the influence of informal institutions was soften in the first phase of the study period because of the British hegemony over the basin, it began gradually to dominate the bilateral interactions between Egypt and Ethiopia with the gradual British withdrawal from Egypt and the Nile Basin. During the first phase of the British colonisation of Egypt that extended from 1882 until the end of 1920s, the United Kingdom successfully concluded a treaty on behalf of Egypt and Sudan with Ethiopia in 1902. In this treaty, the British government recognised the sovereignty of Ethiopia in return for securing the Egyptian interests in the Nile water. This was a direct application of the rational game theory model of issue linkages, where one player links questions outside the water sharing negotiations. However, with the partial independence of Egypt in 1922, the negotiations over the Nile water utilisation began to be conducted directly between the two riparian countries. Although the British government mediated the negotiations during this period to protect its interests in the Nile water, but the negotiations were conducted by the direct beneficiaries themselves. The research demonstrated that there was an opportunity to conclude successfully the negotiations between the two parties if the informal institutions were neutralised. Ethiopia could have traded the hydrological interests of Egypt in return of its hydropower interests. However, the historical conflict over the Nile ownership hindered them from strategically managing the coordination game to reach a

cooperative outcome. Furthermore, with the full independence of Egypt in 1954, these conflictive informal institutions dominated the interactions between the countries. The successive interactions between Egypt and Ethiopia since the end of 1950s took the form of confrontations where the party that chickened out, lost the game. Furthermore, the negative informal institutions contributed to the stringent positions adopted by Ethiopia and Egypt in the negotiations of the Cooperative Framework. Thus, in sum, it could be concluded that the informal institutions between Egypt and Ethiopia have played a negative role that impeded their efforts to reach a cooperative agreements on the Nile water utilisation.

Similarly, the evolution of negative informal institutions between Egypt and the upstream countries in the second half of the twentieth century had curbed the cooperation drive that characterised the Egyptian-Ugandan relation in the first half of the same century. The neutrality of informal institutions that characterised the Ugandan Egyptian relations during the British colonisation enabled the British administration lead a successful negotiations that led to the treaty of 1929. Furthermore, even when Egypt gained its partial independence, both countries managed to reach a cooperative agreement over Owen Falls Dam. In this agreement, Egypt and Uganda succeeded to achieve what Egypt and Ethiopia failed to achieve at the same period. Egypt exchanged it interests in Nile water in return for supporting the Ugandan efforts to generate hydraulic power. Furthermore, after both countries achieved their full independence, the managed to maintain a silent coordination that maintained the governance regime in 1960, which was in favour of both countries. Nevertheless, the gradual evolution of a widespread belief of people in upstream that the Egypt sought to dominate the Nile led to the development of the informal institution that Egypt has been acting as a hegemonic power in the Nile basin. The informal institution of "Egypt´s hegemony" over the basin has been a catalyser for Ugandan position in the negotiations of the Cooperative Framework Agreement. Although the Ugandan position has been technically closer to the Egyptian position, it allied with Ethiopia and the other upstream countries against the downstream countries. Therefore, it can be concluded that informal institutions between Uganda and Egypt has evolved in a way that affected negatively the cooperation between the

two countries.

To the contrary, on the positive side, informal institutions have been a catalyst for cooperation between Egypt and Sudan. The deeply-rooted informal institution of the *brotherhood* between the Egyptian and Sudanese nations has helped both countries to overcome the differences that occurred from time to time regarding the Nile water utilisation. Firstly, it paved the way to the British government to get an Egyptian recognition of Sudanese rights in the water Nile in the Treaty 1929. Consequently, after the independence of two countries, their government were induced by the public opinion in the countries to reach another agreement over the Utilisation of the Nile water in 1959. This agreement enabled Egypt to construct Aswan High Dam and increased the water share of Sudan as well as permitted them construct also the Roseires Dam. It also paved the way to the construction of Jonglei Canal, but unfortunately the project was stopped owning to the internal conflict in Sudan. Last but not least, Sudan has joined Egypt in its position opposing to signature of the current draft of the Common Framework Agreement that does meet the needs of downstream countries. Sudan had mixed interests in this situation. In one side, it has shared the Egyptian concerns from the protection of the water security of downstream countries from any significant harm that can be caused by future projects of upstream countries. On the other, it share the upstream objective of acquiring additional share of the Nile water. However, Sudan preferred to join its historical ally, Egypt, forming an opposition front to the current draft of the Common Framework Agreement. Therefore, it can be argued that informal institutions has strengthen the cooperation between Egypt and Sudan in the question of Nile water.

To summarise, Informal institutions played a major role in shaping the outcomes of interactions among the studied Nile riparian countries. The Egyptian Ethiopian conflict over the owner ship of the Nile, and to a lesser degree the conflictive religious informal institutions, have represented an obstacle in front of the cooperation between the two countries in the Nile water question. On the Ugandan side, the development of hostile informal institutions in the last fifty years had negative consequences on the coordination between Uganda and Egypt. To the contrary, the brotherly informal institutions between Egypt and Sudan has

promoted the cooperation between them.

2.2 Egyptian institutional framework & benefits distribution

The study analysed the impact the Egyptian institutional environment on the distribution of benefits accrued to Egypt by the changes in the Nile government regime. This analysis revealed the significance of the influence of the Egyptian national institutional environment on the benefits of Nile water that accrued to the Egyptian economy and on the distribution of these benefits among the different sectors of the Egyptian population.

In general, the Egyptian national institutional environment has translated the Egyptian benefits from the Nile basin management regime to economic growth in most of the study period. The Egyptian agriculture-based economy have transformed the growing water supply that was secured by the Basin-wide institutional change during colonial phase into a steady economic growth that reached its peak at the end of this phase with economic growth rate of 18%. Moreover, the profits of the agricultural sector ware used to structurally transform the economy, increasing the share of industry from 5% to around 18% of GDP. The same trend continued in the post-colonial period, especially after the treaty of 1959 and the construction of Aswan High Dam. Egypt continued to record growth rates above 5%. The agricultural sector and the hydropower energy generated by the High Dam were among the pillars of this economic development. Furthermore, although the Egyptian Israeli wars during 1960s and 1970s, Egypt returned to record growing growth rates since 1990s. Although the share of the agricultural sector declined to 20% of GDP, it contributed not only to national food security but also as an export sector, especially from the newly cultivated lands. However, it should be noted that during the last phase the imbalances in the institutional environment and the fragmentation of the water-related governance structures have affected negatively the efficiency of the water-related sectors and reduced their contribution the growth of the Egyptian economy.

However, the distribution of the benefits of the growing Egyptian share of the Nile water and the resulting economic growth has been far from being uniform. With exception of the period of 1950s-1960s, the successive institutional environments in Egypt have distributed these benefits unevenly among the different social classes. Most of the wealth created by the Agriculture-based economic boom that Egypt witnessed during the colonial phase was channelled through the existing institutional environment to the land-owner elite and the capitalist class. Only during the 1950s and 1960s, the post-colonisation regime created an institutional environment that used the accumulated wealth to enhance the capabilities of the middle-income segment and the urban poor class and to a lesser extent the capabilities of rural poor classes. However, the trend was reversed gradually since the end of 1980s as a result of the economic reform programmes that were sponsored by the International Monetary Fund and the World Bank. The new economic trend led to the revival of the colonisation pattern of benefits distribution. This new pattern negatively affected the capabilities of the middle and low-income classes while the elite class maintain its enhanced capabilities. The heaviest burden of reform was assumed by the class that has the closest link with the Nile, the rural non-landed classes. This poor class has experienced a deterioration in its capabilities of leading an acceptable sustainable livelihood.

In summary, the relation between water supply and the enhancement of people livelihood has been far from being deterministic. The Egyptian institutional environment succeeded to transform this enhanced water supply into economic growth during most of the study period. However, the impact of the increasing water supply on the livelihood of the different segments of people capabilities was influenced by the changes occurred in the Egyptian institutional framework during the study period. The higher social classes have gained most of the benefits of these economic advances while the lower classes were the least beneficiary of this economic growth. In sum, the distribution of benefits of the growth of the water-related sectors has been biased in favour of the elite classes on the expense of the lower social classes, especially the poor rural classes who have suffered from a severe erosion in their capabilities during the last phase of the study period.

3 Conclusions & Final remarks

This research set out with the aim of understanding dynamics of the interactions among the riparian countries of the Nile Basin during the modern history of the Nile and its impacts on the population of the Basin. The study period chosen to start with the British colonisation as it marked the modern effort to control the Nile River and establish a basin-wide management regime. Moreover, the study of the impact on population welfare was limited to Egypt provide a more focused analysis. However, the same analysis can be applied to any other riparian country or even to all riparian countries. The research employed a multi-level framework that integrated the various models of the new institutional economics with the capability approach. The main hypothesis was that the informal institutions of the riparian countries have impeded the cooperation attempts during the study period from achieving their optimal outcomes.

The analysis conducted confirmed the hypothesis of the study and revealed some additional conclusions. With regards to the inter-riparian cooperation. Although the informal institutions have played positive roles in some interaction, its overall impact was negative. It contributed to the failure of most of main interactions among riparian countries that have been carried out after the end of the British colonisation of most of the countries of the basin, including the current deadlock over the Cooperative Framework Agreement. With regard to the impact of the national institutional framework on the water-related benefits accrued to people, it has been found that the benefits of the basin-wide regime changes accrued to the national economy and the different segments of the population have been shaped by the different levels of national institutional Framework.

The evidence from this study suggests that the inter-riparians cooperation to establish a basin-wide management regime should continue with a gradual process that deal address both the economic and non-economic motives of the riparian countries. This process should to soften the negative impact of the inherited beliefs while working on changing them gradually over time. Moreover, this process should focus on the non-conflictive issues in its early stages while leaving the water sharing

questions to later stages when the riparian nations are ready to address them in a pragmatic way to reach win-win solutions.

The research contributes to produce advances in two fields: the understanding of Nile basin governance regime and analytical methods of common resources management. The research has three main contribution to research and knowledge in this field. Firstly it enhances our understanding of the dynamic process of Nile Basin governance system development. Secondly, it highlights the influence of the national institutional framework on the impacts of benefits of water resources on the livelihood of the different segments of population. Therefore, the study allows for a more enlightened planning of future national water policy with a clearer understanding of its probable outcomes. Finally, the study attempted to introduce an integrated analytical framework that can be used not only to analyse transboundary water resources but also to analyse any other type of common resources.

Finally, it worth highlighting that the research examined the role of national institutional environment in translating the water-related resources to national economic growth and development. However, has not analysed the potential impact of reforming the water sector in Egypt on its future needs of the Nile water and on the future of relations among Nile basin countries. Therefore, the analysis of the mutual interdependence between water resources management in Egypt and transboundary management of Nile water can be an important potential theme of future research.

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APPENDIX

PROTOCOLS

BETWEEN THE GOVERNMENTS OF GREAT BRITAIN AND ITALY, FOR THE DEMARCATION OF THEIR RESPECTIVE SPHERES OF INFLUENCE IN EASTERN AFRICA,

SIGNED AT ROME,

MARCH 24, 1891

AND

APRIL 15, 1891.

Protocol signed on the 24th March, 1891.

Les Soussignés,

Marquis de Dufferin et Ava, Ambassadeur de Sa Majesté la Reine du Royaume-Uni de la Grande- Bretagne et d'Irlande, Impératrice des Indes ; et

Marquis de Rudini, Président du Conseil et Ministre des Affaires Étrangères de Sa Majesté le Roi d'Italie ;

Après mûr examen des intérêts respectifs des deux pays dans l'Afrique Orientale, sont convenus de ce que suit : —

1. La ligne de démarcation, dans l'Afrique Orientale, entre les sphères d'influence respectivement réservées à la Grande-Bretagne et à l'Italie, suivra à partir de la mer, le "thalweg" du fleuve de Juba jusqu'au 6° nord jusqu'au méridien 35° est Greenwich, qu'elle remontera jusqu'au Nil Bleu.

2. Si les explorations ultérieures venaient, plus tard, en indiquer l'opportunité, le tracé suivant le 6° Latitude nord et 35° longitude est Greenwich pourra, dans ses détails, être amendé d'un commun accord, d'après les conditions hydrographiques de la contrée.

3. Il y aura, dans la station de Kismayu et son territoire, égalité de traitement entre sujets et protégés des deux pays, soit pour leurs personnes, soit à l'égard de leurs biens, soit enfin en ce qui concerne l'exercice de toute sorte de commerce et industrie.

Fait à Rome, en double exemplaire, le 24 Mars, 1891.

(L.S.) DUFFERIN and A V A.

Protocol signed on the 15th April, 1891.

Marquis de Dufferin et Ava, Ambassadeur de Sa Majesté la Reine du Royaume-Uni de la Grande Bretagne et d'Irlande, Impératrice des Indes ;

Marquis de Rudini, Président du Conseil et Ministre des Affaires Étrangères de Sa Majesté le Roi d'Italie ;

Sont convenus de ce qui suit : —

I. La sphère d'influence réservée à l'Italie est limitée, au nord et à l'ouest, par une ligne tracée depuis Ras Kasar sur la Mer Rouge au point d'intersection du 17 E parallèle nord avec le 37 E méridien est Greenwich. Le tracé, après avoir suivi ce méridien jusqu'au 16° 30' latitude nord, se dirige, depuis ce point, en ligne droite, à Sabderat, laissant ce village á l'est. Depuis ce village le tracé se dirige au sud jusqu'à un point sur le Gash a 20 milles Anglais en amont de Kassala, rejoignant L'Atbara au point indiqué comme étant un gué dans la Carte de Werner Munzinger, " Original- karte von Nord Abessinien und den Länder am Mareb, Barca, und Anseba," de 1864 (Gotha, Justus Perthes), et situé au 14° 52' latitude nord. Le tracé remonte ensuite l'Atbara jusqu'au confluent du Kor Kakamot (Hahamot), d'ou il va dans la direction d'ouest jusqu'à la rencontre du Kor Lemsen, qu'il redescend jusqu'à son confluent avec le Rahad. Enfin, le tracé, après avoir suivi le Rabad pour le bref trajet entre le confluent du Kor Lemsen et l'intersection du 35° longitude est Greenwich, s'identifiera, dans la direction du sud, avec ce méridien jusqu'à la rencontre du Nil Bleu, sauf amendements ultérieurs de détails d'après les conditions hydrographiques et orographiques de la contrée.

II. Le Gouvernement Italien aura la faculté, au cas où il serait obligé de le faire pour les besoins de sa situation militaire, d'occuper Kassala et la contrée attenante jusqu'à l'Atbara. Cette occupation ne pourra, en aucun cas, s'étendre au nord, ni au nord-est de la ligne suivante : —

De la rive droite de l'Atbara, en face de Gos Rejeb, la ligne va dans la direction d'est jusqu'à l'intersection du 36 E méridien est Greenwich ; de là, tournant au sud-est, elle passe a 3 milles au sud des points marqués Filik et Metkinab dans la carte précitée de Werner Munzinger, et rejoint le tracé mentionné dans l'Article I à 25 milles Anglais au nord de Sabderat, mesurés le long du dit tracé.

IL est cependant convenu entre les deux Gouvernements que toute occupation militaire temporaire du territoire additionnel spécifié dans cette Article n'abrogera pas les droits du Gouvernement Égyptien sur le dit territoire, mais ces droits demeureront seulement en suspens jusqu'à ce que le Gouvernement Égyptien sera en mesure de réoccuper le district en question jusqu'au tracé indiqué dans l'Article I de ce Protocole, et d'y maintenir l'ordre et la tranquillité.

III. Le Gouvernement Italien s'engage à ne construire sur l'Atbara, en vue de l'irrigation, aucun ouvrage qui pourrait sensiblement modifier sa défluence dans le Nil.

IV. L'Italie aura, pour ses sujets et protégés, ainsi que pour leurs marchandises, le passage en franchise de droits sur la route entre Metemma et Kassala, touchant successivement El Affareh, Doka, Suk- Abu-Sin (Ghedaref), et l'Atbara.

Fait à Rome, en double exemplaire, ce 15 Avril, 1891.

(L.S.) DUFFERIN and AVA.

(L.S.) RUDINI.

TREATIES

BETWEEN THE UNITED KINGDOM AND ETHIOPIA,

AND

BETWEEN THE UNITED KINGDOM, ITALY, AND ETHIOPIA

RELATIVE TO THE FRONTIERS BETWEEN THE SOUDAN, ETHIOPIA AND ERITREA.

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AND BETWEEN THE

UNITED KINGDOM, ITALY, AND ETHIOPIA,

RELATIVE TO

THE FRONTIERS BETWEEN THE SOUDAN, ETHIOPIA, AND ERITREA.

Signed at Adis Ababa, May 15, 1902.

[*Ratifications delivered at Adis Ababa, October* 28, 1902.]

[WITH A MAP.]

Presented to both Houses of Parliament by Command of His Majesty.
December 1902.

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Signed at Adis Ababa, May 15, 1902.

(Signed also in the Amharic text.)

[*Ratifications delivered at Adis Ababa, October* 28, 1902.]

His Majesty Edward VII by the Grace of God, King of the United Kingdom of Great Britain and Ireland, and of the British Dominions beyond the Seas, Emperor of India, and His Majesty Menelek II, by the Grace of God, King of Kings of Ethiopia, being animated with the desire to confirm the friendly relations between the two Powers, and to settle the frontier between the Soudan and Ethiopia, and His Majesty King Edward, having appointed as his Plenipotentiary Lieutenant-Colonel John Lane Harrington, a Commander of the Royal Victorian Order, His Majesty's Agent at the Court of His Majesty Menelek II, King of Kings of Ethiopia, whose full powers have been found in due and proper form, and His Majesty the Emperor Menelek, negotiating in his own name as King of Kings of Ethiopia, they have agreed upon and do conclude the following Articles, which shall be binding on themselves, their heirs, and successors:

ARTICLE I.

The frontier between the Soudan and Ethiopia agreed on between the two Governments shall be: the line which is marked in red on the map annexed to this Treaty in duplicate, and traced from Khor Um Hagar to Gallabat, to the Blue Nile, Baro, Pibor, and Akobo Rivers to Melile, thence to the intersection of the 6th degree of north latitude with the 35th degree longitude east of Greenwich.

ARTICLE II.

The boundary, as defined in Article I, shall be delimited and marked on the ground by a Joint Boundary Commission, which shall be nominated by the two High Contracting Parties, who shall notify the same to their subjects after delimitation.

ARTICLE III.

His Majesty the Emperor Menelek II, King of Kings of Ethiopia, engages himself towards the Government of His Britannic Majesty not to construct, or allow to be constructed, any work across the Blue Nile, Lake Tsana, or the Sobat which would arrest the flow of their waters into the Nile except in agreement with His Britannic Majesty's Government and the Government of the Soudan.

ARTICLE IV

His Majesty the Emperor Menelek, King of Kings of Ethiopia, engages himself to allow His Britannic Majesty's Government and the Government of the Soudan to select in the neighbourhood of Itang, on the Baro River, a block of territory having a river frontage of not more than 2,000 metres, in area not exceeding 400 hectares, which shall be leased to the Government of the Soudan, to be administered and occupied as a commercial station, so long as the Soudan is under the Anglo-Egyptian Government. It is agreed between the two High Contracting Parties that the territory so leased shall not be used for any political or military purpose.

ARTICLE V.

His Majesty the Emperor Menelek, King of Kings of Ethiopia, grants His Britannic Majesty's Government and the Government of the Soudan the right to construct a railway through Abyssinian territory to connect the Soudan with Uganda.

A route for the railway will be selected by mutual agreement between the two High Contracting Parties.

The present Treaty shall come into force as soon as its ratification by His Britannic Majesty shall have been notified to the Emperor of Ethiopia.

In faith of which His Majesty Menelek II, King of Kings of Ethiopia, in his own name, and Lieutenant-Colonel John Lane Harrington, on behalf of His Majesty King Edward VII,

King of the United Kingdom of Great Britain and Ireland and of the British Dominions beyond the Sea, Emperor of India, have signed the present Treaty, in duplicate, written in the English and Amharic languages, identically, both texts being official, and have thereto affixed their seals.

Done at Adis Ababa, the 15th day of May, 1902.

(L.S.) JOHN LANE HARRINGTON,
Lieutenant-Colonel.

(Seal of His Majesty the Emperor Menelek II.)

Note.

Annex to the Treaty of 10th July, 1900, regarding the frontier between Ethiopia and Eritrea, and the Treaty of 15th May, 1902, regarding the frontier between the Soudan and Ethiopia.

Nota.

Aggiunta al Trattato del 10 Luglio, 1900, per la frontiera fra Etiopia ed Eritrea ed al Trattato del 15 Maggio, 1902, per la frontiera fra Sudan ed Etiopia.

His Majesty the Emperor of Ethiopia, Menelek II, Major Ciccodicola, Italian Minister in Ethiopia, and Lieutenant-Colonel Harrington, His Britannic Majesty's Agent in Ethiopia, have mutually agreed that:

Di comune accordo fra S. M. l'Imperatore di Etiopia, Menelik II, il Maggiore Comre. Ciccodicola, Ministro d'Italia in Etiopia, ed il Tte. Colonnello Harrington, Agente Diplomatico del Governo Britannico in Etiopia, è stato convenuto quanto segue:

ARTICLE I.

The frontier Treaty between Ethiopia and Eritrea, previously determined by the line Tomat–Todluc, is mutually modified in the following manner:

Commencing from the junction of the Khor Um Hagar with the Setit, the new frontier

ARTICOLO I.

Il Trattato di frontiera fra l'Etiopia e la Colonia Eritrea, determinato finora dalla linea Tomat–Todluc, di comune accordo viene modificato nel seguente modo:

A cominciare dalla confluenza del Khor-Um-Hagar col Setit, la nuova frontiera segue questo

follows this river to its junction with the Maieteb, following the latter's course so as to leave Mount Ala Tacura to Eritrea, and joins the Mareb at its junction with the Mai Ambessa.

The line from the junction of the Setit and Maieteb to the junction of the Mareb and Mai Ambessa shall be delimited by Italian and Ethiopian delegates, so that the Canama tribe belong to Eritrea.

fiume fino alla confluenza del Maiteb, si tiene lungo il corso di esso lasciando alla Eritrea il Mte. Ala-Tacura, e si dirige al Mareb alla confluenza de Mai Ambessa.

La linea compresa fra la confluenza del Maiteb col Setit e quella del Mai Ambessa col Mareb sarà determinata sul terreno da oppositi delegati, Italiani ed Etiopi, in maniera che la tribu dei Cunama rimanza alla Colonia Eritrea.

ARTICLE II.

The frontier between the Soudan and Eritrea, instead of that delimited by the English and Italian delegates by the Convention of the 16th April, 1901, shall be the line which, from Sabderat, is traced viâ Abu Jamal to the junction of the Khor Um Hagar with the Setit.

ARTICOLO II.

La frontiera fra il Sudan et l'Eritrea, invece di essere quella delimitata dai delegati Inglese ed Italiano con la Convenzione del 16 Aprile, 1901, sarà la linea che da Sabderat per Abu-Gamal va alla confluenza del Khor-Um-Hagar col Setit.

The present Agreement shall come into force as soon as its ratification by the British and Italian Governments shall have been notified to the Emperor of Ethiopia.

Gli accordi sopraindicati accettati da S. M. l'Imperatore d'Etiopia, Menelek II, avranno esecuzione quando questa Nota sarà stata ratificata dai Governi Inglese ed Italiano.

In faith of which His Majesty the Emperor of Ethiopia, Menelek II, in his own name and that of his successors; Major Ciccodicola, in the name of His Majesty Victor Emmanuel III, King of Italy, and his successors; and Lieutenant-Colonel Harrington, in the name of His Majesty Edward VII, King of the United Kingdom of Great Britain and Ireland and of the British Dominions

In fede di quanto sopra, S. M. l'Imperatore di Etiopia, Menelek II, per se e pei suoi successori; il Comre. Maggiore Ciccodicola, Ministro d'Italia in Etiopia, in nome di S. M. Vittorio Emanuele III, Re d'Italia, per lui e pei suoi successori; ed il Tte. Colonnello Harrington, in nome di S. M. Edoardo VII, Re dei Regni Uniti di Gran Brettagna ed Irlanda, dei dominii Britannici d'oltre mare, Imperatore

beyond the Seas, Emperor of India, and his successors, have signed the present Note in triplicate, written in the Italian, English, and Amharic languages identically, all texts being official, and have thereto affixed their seals.

delle Indie, per lui e pei suoi successori, hanno sottoscritta questa Nota, scritta in 3 copie, in lingua Inglese, Italiana, ed Amarica, identicamente e dello stesso valore, e vi hanno apposti i loro sigilli.

Done at Adis Ababa, this 15th day of May, 1902.

Scritta nella città di Addis Ababa, il 15 Maggio, 1902.

(L.S.) JOHN LANE HARRINGTON,
Lieutenant-Colonel.

(L.S.) MAGGIORE FEDERICO CICCODICOLA.

(Seal of His Majesty the Emperor Menelek II.)

EXCHANGE OF NOTES

BETWEEN

HIS MAJESTY'S GOVERNMENT IN THE UNITED KINGDOM

AND

THE EGYPTIAN GOVERNMENT

IN REGARD TO THE

USE OF THE WATERS OF THE

RIVER NILE FOR IRRIGATION PURPOSES

CAIRO, MAY 7, 1929

985

Treaty Series No. 17 (1929)

Exchange of Notes

BETWEEN HIS MAJESTY'S GOVERNMENT
IN THE UNITED KINGDOM
AND THE EGYPTIAN GOVERNMENT

in regard to the

Use of the Waters of the River Nile for Irrigation Purposes

Cairo, May 7, 1929

[WITH SEVEN DIAGRAMS]

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Exchange of Notes between His Majesty's Government in the United Kingdom and the Egyptian Government in regard to the Use of the Waters of the River Nile for Irrigation Purposes.

Cairo, May 7, 1929.

No. 1.

Mohamed Mahmoud Pasha to Lord Lloyd.

Présidence du Conseil des Ministres,
Cairo, May 7, 1929.

Excellency,

In confirmation of our recent conversations, I have the honour to communicate to your Excellency the views of the Egyptian Government in regard to those irrigation questions which have been the subject of our discussions.

The Egyptian Government agree that a settlement of these questions cannot be deferred until such time as it may be possible for the two Governments to come to an agreement on the status of the Sudan, but, in concluding the present arrangements, expressly reserve their full liberty on the occasion of any negotiations which may precede such an agreement.

2. It is realised that the development of the Sudan requires a quantity of the Nile water greater than that which has been so far utilised by the Sudan. As your Excellency is aware, the Egyptian Government has always been anxious to encourage such development, and will therefore continue that policy, and be willing to agree with His Majesty's Government upon such an increase of this quantity as does not infringe Egypt's natural and historical rights in the waters of the Nile and its requirements of agricultural extension, subject to satisfactory assurances as to the safeguarding of Egyptian interests as detailed in later paragraphs of this note.

3. The Egyptian Government therefore accept the findings of the 1925 Nile Commission, whose report is annexed hereto, and is considered an integral part of the present agreement. They propose, however, that, in view of the delay in the construction of the Gebel Aulia Dam, which, under paragraph 40 of the Nile Commission's Report, is regarded as a counterpart of the Gezira scheme, the dates and quantities of gradual withdrawals of water from the Nile by the Sudan in flood months as given in article 57 of the Commission's Report be modified in such a manner that the Sudan should not withdraw more than 126 cubic metres per second. before 1936, it being understood that the schedule contained in the above-mentioned article will remain unaltered until the discharge of 126 cubic metres per second is reached. These quantities are based

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on the Nile Commission's Report, and are therefore subject to revision as foreseen therein.

4. It is further understood that the following arrangements will be observed in respect of irrigation works on the Nile :—

(i.) The Inspector-General of the Egyptian Irrigation Service in the Sudan, his staff, or any other officials whom the Minister of Public Works may nominate, shall have the full liberty to co-operate with the Resident Engineer of the Sennar Dam in the measurement of discharges and records to satisfy the Egyptian Government that the distribution of water and the regulation of the dam are carried out in accordance with the agreement reached. Detailed working arrangements agreed upon between the Minister of Public Works and the Irrigation Adviser to the Sudan Government will take effect as from the date of the confirmation of this note.

(ii.) Save with the previous agreement of the Egyptian Government, no irrigation or power works or measures are to be constructed or taken on the River Nile and its branches, or on the lakes from which it flows, so far as all these are in the Sudan or in countries under British administration, which would, in such a manner as to entail any prejudice to the interests of Egypt, either reduce the quantity of water arriving in Egypt, or modify the date of its arrival, or lower its level.

(iii.) The Egyptian Government, in carrying out all the necessary measures required for the complete study and record of the hydrology of the River Nile in the Sudan, will have all the necessary facilities for so doing.

(iv.) In case the Egyptian Government decide to construct in the Sudan any works on the river and its branches, or to take any measures with a view to increasing the water supply for the benefit of Egypt, they will agree beforehand with the local authorities on the measures to be taken for safeguarding local interests. The construction, maintenance and administration of the above-mentioned works shall be under the direct control of the Egyptian Government.

(v.) His Britannic Majesty's Government in the United Kingdom of Great Britain and Northern Ireland shall use their good offices so that the carrying out of surveys, measurements, studies and works of the nature mentioned in the two preceding paragraphs is facilitated by the Governments of those regions under British influence.

(vi.) It is recognised that in the course of the operations here contemplated uncertainty may still arise from time to time either as to the correct interpretation of a question of principle or as to technical or administrative details. Every question of this kind will be approached in a spirit of mutual good faith.

4922 Wt. —— 1125 7/29 F.O.P. 19434 B 2

In case of any difference of opinion arising as to the interpretation or execution of any of the preceding provisions, or as to any contravention thereof, which the two Governments find themselves unable to settle, the matter shall be referred to an independent body with a view to arbitration.

5. The present agreement can in no way be considered as affecting the control of the river, which is reserved for free discussion between the two Governments in the negotiations on the question of the Sudan.

I avail, &c.

M. MAHMOUD, *President*,
Council of Ministers.

Enclosure in No. 1.

Nile Commission, 1925.

Report.

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* Not reproduced.

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CHAPTER I.

Introductory.

The appointment of the Commission arose from an exchange of notes dated the 26th January, 1925, between His Britannic Majesty's High Commissioner for Egypt and the President of the Egyptian Council of Ministers, in which it was agreed that a Commission should be appointed "for the purpose of examining and proposing the basis on which irrigation can be carried out with full consideration of the interests of Egypt and without detriment to her natural and historic rights."*

2. The following were appointed members of the Commission :—

Mr. J. J. Canter Cremers, *Chairman.*
Mr. R. M. MacGregor, British Delegate.
Abdel Hamid Soliman Pasha, Egyptian Delegate.

The Commission was called upon to report by the 30th June, 1925.

The Chairman arrived in Egypt on the 16th February, and the first meeting was held on the following day.

Mr. W. Allard, of the Egyptian Irrigation Department, was appointed Secretary.

3. After preliminary discussions and visits to the Delta Barrage and the offices of the Physical Department, the Commission was able to lay its plans and to define the general lines of statistical examination. It next visited the sadd near Edfina, which is made annually to close the mouth of the Rosetta branch of the Nile; and then proceeded on a tour of inspection up the Nile, including the Sennar Dam and the canalisation works of the Sudan Gezira, the site of the proposed Gebel Aulia Dam, the Aswan Dam, the Isna Barrage, the site of the proposed Nag-Hamadi Barrage, and the basin systems in the vicinity of Sohag.

4. During the course of its sittings in Cairo and its tours of inspection, the Commission examined many of the records of the Physical and Irrigation Departments, and obtained by interviews the opinions of various officials, both in Egypt and the Sudan, on subjects connected with its task. On its return to Cairo at the end of March, the Commission applied itself to an examination of the statistics as they became available, calling from time to time for such further data as the progress of the enquiry rendered necessary.

5. The Commission agreed at the outset of its deliberations that decisions arrived at during the examination of the problem, point by point, should in the first instance be provisional and subject to review at a later stage when it became possible to envisage the problem as a whole. By the early part of May most of the ground had been covered, and a large measure of agreement had been reached. On certain points further statistical information was

* See Notes reproduced as Appendix A.

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still awaited. It was decided at this stage that further progress would be facilitated by the preparation of a draft report embodying the conclusions so far reached, and it was arranged that the two delegates should prepare separate drafts, from which, with the assistance of the Chairman, the final draft would be compiled.

6. At this juncture, the Chairman's health began to cause anxiety, and he found it increasingly difficult to take part in the work of the Commission. On the 21st May his indisposition took a graver turn, and it was realised that he was seriously ill. For some weeks there was every hope of his recovery, but most unhappily and to the great grief of his colleagues, he died on the 21st June. The British and Egyptian delegates take this opportunity of placing on record their appreciation of the high professional and personal gifts of their late colleague and their sense of the loss sustained by the Commission over which he had so ably presided, and by the engineering profession in general, through his untimely death.

7. The Chairman's illness necessitated the temporary adjournment of the Commission at a time when its task was within measurable distance of completion, and his subsequent death obliged the two Governments to consider the most appropriate course to follow in these unforeseen circumstances. The delegates meanwhile had returned to their normal duties. In view of the progress that had already been made, and the desirability of completing the work, the two Governments eventually instructed their respective delegates to resume the studies, so unhappily interrupted, and to present their Report.

8. The remaining statistical information having been obtained, the two delegates reviewed the alternative drafts already prepared; and finding no reason to depart substantially from any proposals common to both of them, they proceeded to compile this agreed Report, which they believe would have met with the approval of their late Chairman.

CHAPTER II.

Descriptive and General.

Previous History.

9. After the re-establishment of order in the Sudan, as a result of the campaign of 1896–98, a demand arose in the Sudan for the erection of pumps for irrigation on a small scale; and, with the approval of the Egyptian Government, certain areas of land were given pumping rights. The area under permit was increased from time to time, as explained in detail in a later paragraph, some pumps being installed to test the possibilities of cotton growing, and others for the purpose of producing food grains at a time of scarcity during the war. The area now under irrigation in this way is inconsiderable, amounting to less than 40,000 feddans, of which rather more than half is licensed for perennial irrigation, the remainder being restricted to the flood season. An area of some

80,000 feddans in the Northern Sudan has been formed into basins, but, owing to the high levels of the land, they are only partly filled, even in years of high flood.

10. The greater part of the culturable land of the Sudan either possesses an adequate rainfall or is inaccessible by canals. The only considerable area suitable for canal irrigation is the triangular tract between the Blue and White Niles with its apex at Khartum and extending as far south as the Sennar–Kosti Railway. From 1905 onwards the possibility of irrigating some portion of this area had been under consideration; and in 1913 a scheme was prepared for the irrigation of 100,000 feddans by means of a canal fed from the natural flow of the Blue Nile, the required levels being given by a barrage at Makwar. It was then believed that such a scheme would permit of the cotton crop being matured without detriment to Egyptian interests. Further experience of agricultural conditions, however, and the occurrence of the exceptionally low river of 1913-14, showed that this was impossible, and that the scheme should comprise a storage dam, and not merely a diversion barrage. With the addition of a reservoir for the storage of water abstracted from the natural flow during the flood season, it was calculated that the area could be increased to 300,000 feddans without the need for taking water from the river at low stage, and that such an increase of area was necessary to off-set the extra cost of the dam. The scheme was recast on these lines, but progress was interrupted by the war.

11. Simultaneously, the Egyptian Government had been considering the construction of a dam on the White Nile at Gebel Aulia, near Khartum, for the dual purpose of controlling high floods which threatened damage to Egypt, and of storing water for use during the summer season in Egypt. This scheme was also delayed by the war, though some work was actually executed during the years 1917–20.

12. The resumption of progress on both of these projects after the war was accompanied by vigorous public discussion and criticism in Egypt, directed chiefly against the accuracy of the data on which they were based. As a result of this the Egyptian Government in January 1920 appointed a Commission of Enquiry, known as the Nile Projects Commission, composed of three members, nominated by the Government of India, the University of Cambridge and the Government of the United States. The terms of reference to the Commission were as follows:—

> The Commission is requested to give to the Egyptian Government its opinion of the projects prepared by the Ministry of Public Works with a view to the further regulation of the Nile supply for the benefit of Egypt and the Sudan. In particular, the Commission is requested—
>
> (i.) To examine and report upon the physical data on which the projects are based.
>
> (ii.) To report upon the propriety of the manner in which, as a result of these projects, the increased supply of available

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water provided by them will be allocated at each stage of development between Egypt and the Sudan.

(iii.) To advise as to the apportionment of the cost of the proposed works and of this enquiry as between Egypt and the Sudan.

The projects were those described in a publication of the Egyptian Government entitled "Nile Control," and comprised the two dams already mentioned, a barrage in Upper Egypt, conservation works in the "Sadd" region and storage reservoirs in the Great Lakes.

13. The report of the Nile Projects Commission, which was published in 1921, found that the projects were based on reliable data, and advocated their execution. In view, however, of the estimated heavy cost of the Gebel Aulia Dam and its complementary works, the Egyptian Government decided in May 1921 to suspend all operations in connexion with this project: The Sudan Government, on the other hand, in view of the favourable report, decided to continue work on the Gezira Irrigation Scheme.

14. The majority of the Nile Projects Commission felt unable to advise on the problem of allocating those supplies of water which still remained unappropriated, and the only proposals made in this connexion, namely, those of Mr. Cory, the American member, were not adopted.

15. In view of the situation which had led to the appointment of the above-mentioned Commission, the British Government gave, in February 1920, an undertaking that the area of 300,000 feddans comprised in the Gezira Irrigation Scheme would not be exceeded without reference to the Egyptian Government; and the work has been carried out within this limitation.

The Present Position.

16. The immediate programme of works outlined in "Nile Control" consisted of the following items:—

(i.) The Gebel Aulia Dam to provide additional water for Egypt.

(ii.) The Makwar Dam, or, as it is now called, the Sennar Dam, with a canal system to irrigate 300,000 feddans in the Sudan Gezira.

(iii.) A barrage at Nag-Hamadi in Upper Egypt.

For various reasons, first the war, and then financial and other difficulties, no progress has been made with items (i) and (iii). On the other hand, item (ii) has been carried to completion, and came into operation in July 1925. The cost of this work has greatly exceeded the original estimates, and the Sudan Government, who are responsible for its financial results, desire to extend the area so as to reduce the risk of financial failure, and generally to develop still further the resources of the country.

17. It was an important feature of the programme that these three works should be carried out so as to come into operation simultaneously. The actual position, however, with which the Commission has to deal is that the Sudan has completed the canalisation of 300,000 feddans in the Gezira, and desires to advance a further stage, while Egypt has not yet been able to carry out her part of the original programme. During the time which has elapsed since the Commission was adjourned, the Egyptian Government have made considerable progress with their development programme, having now definitely sanctioned the construction of the Gebel Aulia Dam and the Nag-Hamadi Barrage, and the undertaking of an initial stage in the work of conserving the flow of the river in its course through the "Sadd" region.

18. The position as regards the limit of 300,000 feddans was modified by notes which passed between the British and Egyptian Governments in 1924 and 1925, of which the last two, giving rise to the appointment of this Commission, are contained in Appendix A. The effect of these was to terminate the 300,000-feddan limitation of 1920, and to call for some new arrangement to regulate expansion of irrigation in the Gezira.

Scope of the Present Proposals.

19. The Nile Projects Commission of 1920 had been requested to examine and to give its opinion on certain projects then under construction or under consideration by the Ministry of Public Works. A less specific charge has been laid upon the present Commission, which has been asked only to propose a basis for irrigation in which full consideration should be given to the rights and interests of Egypt. The Commission was thus left free to choose its own ground, to decide how far and in what direction its investigations should be carried, and the form which its proposals should take.

20. The information brought together and the programme of works outlined in the publication entitled "Nile Control," the general conclusions of which were endorsed by the Nile Projects Commission, cover the very wide field of possible development of irrigation by works extending from the Great Lakes in Central Africa to the Mediterranean, and deal with possibilities belonging to the remote future as well as with works more immediately feasible. The present Commission has not attempted so wide a survey and, indeed, the time available precluded any such possibility. Nor has the Commission felt called upon to attempt a general analysis and definition of the principles underlying the allocation of water supplies between two communities. It is content to set out the considerations which have guided it towards its own conclusions.

21. Precedents in this matter of water allocation are rare and practice varied; and the Commission is aware of no generally adopted code or standard practice upon which the settlement of a question of inter-communal water allocation might be based. Moreover, there are in the present case special factors, historical, political and technical, which might render inappropriate too strict an application

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of principles adopted elsewhere. The Commission, having regard to the previous history of the question, the present position as regards development, and the circumstances attending its own appointment, decided to approach its task with the object of devising a practical working arrangement which would respect the needs of established irrigation, while permitting such programme of extension as might be feasible under present conditions and those of the near future, without at the same time compromising in any way the possibilities of the more distant future.

22. The arrangement contemplated aims at interpreting in definite and technical terms the intentions of the note quoted in the opening paragraph of this Report, wherein it was explained that in authorising extensions of irrigation in the Sudan "the British Government, however solicitous for the prosperity of the Sudan, have no intention of trespassing upon the natural and historic rights of Egypt in the waters of the Nile, which they recognise to-day no less than in the past." The Commission has every hope that its proposals, framed in this spirit, and after full study of the technical aspects of the problem, may form an acceptable basis upon which, by harmonious and co-operative effort, the irrigation development of the future may be founded, and by which all existing rights may be perpetually safeguarded.

The Gezira Irrigation Scheme.

23. As already explained, the chief field for irrigation development in the Sudan is the Gezira, and therefore the conditions under which the irrigation of this tract is carried out must have an important bearing on the problem for which the Commission has been called upon to propose a solution. It will be convenient therefore, before proceeding further with the discussion, to give a more detailed account of this scheme.

24. The present scheme provides for the irrigation of an area of 300,000 feddans of cultivable land, of which one-third will be under cotton from July–August to not later than the 15th April, one-third under food crops from August–September to November in the case of durra and January in the case of lubia, and the remaining third fallow. From the 16th April to the 15th July there will be no crop on the ground, water being required for domestic purposes only. The really important crop is the cotton, both from the point of view of water consumption, and of the economic return from the undertaking.

25. From the 16th to the 31st July the canal will be gradually raised from domestic supply level to irrigation supply level, the reservoir level being of necessity raised at the same time. From the 31st July onwards the canal will be drawing its supply in accordance with the agricultural needs, with a maximum discharge of 84 cubic metres a second. During the month of November the reservoir will be raised to full storage level, the discharge taken from the river for

this purpose being about 150 cubic metres a second for thirty days. During the first half of January the watering of lubia will cease, only the cotton remaining under irrigation. The calculations in "Nile Control," upon which the scheme was based, indicated that the requirements of the cotton crop on the above area could be taken from the river without detriment to Egypt, even under the conditions of the abnormally low year 1913–14, up till 18th January, after which date the requirements will have to be met from the stored water in the reservoir. The scheme was accordingly so planned that the reservoir should contain the volume estimated to be necessary, with due allowance for losses, to meet the cotton requirements of the defined area from the 19th January to the 15th April, and domestic requirements from the latter date till the 15th July.

26. Besides the above restrictions as to the season during which the Gezira Scheme should draw upon the natural flow of the river, and the volume of water to be withdrawn during that season, there was the undertaking already mentioned in paragraph 15, limiting the area of cultivation in the Gezira to 300,000 feddans. Thus, even if it were found possible to use less water than the calculations provided for, the water so economised would not be considered as available for an additional area.

Present Commission. General Considerations.

27. From an irrigation point of view, the year in Egypt has always been treated as divisible into two seasons of about six months each. During one of these seasons the whole natural flow of the Nile, supplemented by the stored water of Aswan Reservoir, is used for irrigation, the mouths of the river being closed by earth banks as soon as conditions permit; whilst during the other season water flows to the sea in volumes which for several months are very great.

28. The Sudan Gezira Scheme, which came into operation in July 1925, has been planned so as to draw water from the natural flow of the river only during the latter season, and to draw upon the water stored in the Sennar Reservoir during the low-river season. The Commission regards this as a sound principle; and it is one which has always been accepted by the Sudan authorities, who only claim at this season of the year the volumes necessary for the small area of navigation supplied by pumps under a long-standing arrangement sanctioned by the Egyptian Government. The Commission accordingly determined that its first step should be the accurate division of the year into the two seasons by a detailed examination of the conditions at the two critical points at the beginning and the end of the season of surplus where the change of conditions occurs.

29. When this division of the year had been carried out it would be possible to reserve absolutely to Egypt the natural flow of the river during the low season, subject to the pumping rights already mentioned. The available supplies during the rest of the year would be examined with a view to seeing how much might reasonably be used in the Sudan, taking into account the requirements of corres-

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ponding development in Egypt. It would then remain to examine the minor questions of pump and basin irrigation in the Sudan, and to define the conditions on which these should be carried out.

30. The above are the general lines upon which the Commission decided to develop its proposals. It is now necessary to explain certain principles and methods followed in the actual examination of the problem. The fundamental operation is the division of the year, and in particular the determination of the date at which the Sudan should cease to draw on the natural river at Sennar. The method adopted in "Nile Control" was to make this date correspond with the first withdrawal of stored water at Aswan, and the Sennar Reservoir was designed to supply the requirements of the canal after the 18th January, this date corresponding to the first withdrawal at Aswan in 1913–14, an abnormally low year. The majority of the Nile Projects Commission had approved this method of determining the date, but had advocated that the date should be movable, and ordinarily later than the 18th January, in accordance with the condition of the river in each year, instead of being fixed absolutely with reference to the abnormal conditions of 1913–14.

31. The present Commission does not regard the time of first withdrawal of stored water at Aswan as a suitable criterion of the cessation of surplus flow in the river; since it might well be that the stored water is reserved for some time after there ceases to be any surplus in the river, in anticipation of more acute needs in the later months. The Commission accordingly decided to discard this criterion, and to base its proposals on the actual cessation of surplus as indicated by the working of the canals, the regulation at the Delta Barrage, and the closing of the sadds across the mouths of the river.

32. The Commission considered whether its proposals should be based on the abnormal conditions of 1913–14, or upon the mean of a series of years, or should provide something in the nature of a sliding-scale under which the date in question would be advanced or put back in accordance with the conditions obtaining in each year. The records of Nile floods cover a period of over 960 years, and years as low as 1913–14 have occurred only four times. The Commission felt that while the occasional occurrence of such years cannot be ignored, it should not be employed as a basis of any scheme. The sliding scale would present complications in working, and it was soon clear that the yearly fluctuations were not so important as to preclude the use of a mean date. It was accordingly decided to work on means, and to test the results so obtained by considering them with reference to specially low years. In particular, the Commission recognised that some special provision might be required to deal with a year like 1913–14.

33. The Commission also had to consider whether its proposals for regulating the expansion of irrigation in the Sudan should be expressed in terms of areas to be irrigated as well as of volumes to be utilised during certain specified seasons. In the past, as explained in paragraph 26, a definite area limitation of 300,000 feddans had been fixed for the Gezira Scheme, in addition to the restrictions imposed naturally by the storage capacity of the reservoir, and the

precise definition of the season during which, and the extent to which, water may be abstracted from the natural flow of the river.

34. It is in terms of volumes and seasons that the actual statistical examination of the whole problem must be conducted, and the record of the working of the reservoir, and of the volumes drawn off daily by the canal, must be maintained. And it is the volumes and seasons which best lend themselves to the imposition of checks necessary to ensure a proper control over the working of whatever arrangement may be arrived at as the result of the Commission's proposals.

35. An area limitation could not, in itself, constitute complete control over the volumes abstracted from the river, unless supplemented by a reservation as to the crops to be grown, and the system of crop rotation to be followed. It would involve also assumptions as to the volumes of water necessary for each different crop, and these assumptions would have to include a considerable margin to allow for error. Such a margin, comprising allowances for doubts as to reservoir capacity, losses, and water requirements of crops, would, by preventing full use being made of very valuable storage water, react unfavourably on the Sudan's interests, without corresponding advantage to Egypt. Consequently, an area limitation, unless pitched too high, would have the effect of removing the incentive to economy in the use of water, and it would clearly be to the advantage of neither party that water taken from the river should be used uneconomically.

36. In view of the above considerations, the Commission decided that its proposals should be stated in terms of volumes and seasons only. It was satisfied that the authorities concerned would have no difficulty in devising arrangements for ensuring complete control over the abstraction of water from the river and from the reservoir. Provided that such satisfactory arrangements are made, the Commission saw no necessity, from a technical point of view, of imposing an area limitation over and above the volumetric one. A definition of seasons and volumes to be extracted would, in accordance with irrigation practice, be satisfactory and adequate in itself; and if it were held necessary, as formerly, to impose an area limitation as well, it would be for reasons outside the purview of a technical Commission.

37. There is another matter which the Commission had to consider in connexion with the method of handling the problem submitted to it. The greater part of Upper Egypt is under basin irrigation, largely dependent on natural flood levels in the river, and only partially protected by barrages. Any abstraction of water in flood time in the Sudan must affect these levels to the detriment of the basin irrigation, and therefore to admit that the lands in question have an absolute right to undiminished natural levels must preclude any abstraction of water by the Sudan.

38. The Commission felt that in the circumstances it was impossible either, on the one hand, to postpone indefinitely all progress in the Sudan, or, on the other, to damage seriously, by precipitate action or by excessive abstraction, the basins of Upper

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Egypt. It was accordingly decided to take the line that consideration of levels could not be carried to the point of precluding development in the Sudan, but only to the point of setting a limit to the extent and rate of this development.

39. The Commission was assisted in coming to this conclusion by the decision of the Egyptian Government, soon after the appointment of the former, to undertake the construction of another barrage in Upper Egypt. It has also now been decided to construct, for the benefit of Egypt, the Gebel Aulia Dam in the Sudan. With the undertaking of these two works the question of levels in Upper Egypt loses much of the importance which might be attached to it if development by the Sudan only were in prospect.

40. A further question of a general nature, calling for decision as a preliminary to detailed examination of the problem, was whether the Gezira Canal and the Gebel Aulia Dam should be treated as being on the same footing, though the latter work had not yet made any effective progress. It was considered that, as both works had originally formed integral parts of the same programme, no special priority should be accorded to the completed Gezira Scheme in respect of the allocation of any further supplies found to be available, but that both should be treated as having equal priority to any extensions. As a corollary to this view, it follows, and it was so assumed by the Commission, that the Sudan should afford every facility for the construction of the Gebel Aulia Dam.

41. Finally, the Commission considered whether it must regard the completed Gezira Scheme as having an irrevocable right to take water to the extent and under the conditions provided for in "Nile Control." There was the possibility that the Commission's examination of the statistics, including those of the years which had elapsed since the scheme was initiated, might lead to conclusions other than those of "Nile Control." At the same time, the scheme had been undertaken and practically completed after full examination of the question, not only by the Egyptian authorities, but by the Nile Projects Commission; and the Sudan Government had entered into certain commitments on the basis of the original water allotment. The Commission felt that in these circumstances any reduction in the volumes available for this scheme would raise issues with which, as a technical body, it would not be concerned. The detailed investigation of the basis of the original scheme by the methods adopted by the Commission has, however, shown, as will be seen later, that no serious divergence exists between the results of the present investigations and those previously arrived at.

CHAPTER III.

STATISTICAL.

42. As a preliminary to the detailed examination of the statistics, it will be convenient to describe briefly the nature of the records available, and to explain certain factors affecting the calculations.

Hydrological Records.

43. The annual maximum and minimum levels at Cairo are on record from 641 to 1451 A.D. and again from 1737, with one break, to the present day. These records cover a period exceeding 960 years, and are of value in determining the periodicity of abnormally low years. Daily gauge readings at Aswan and Cairo were begun in 1870, with occasional discharge observations. Since 1903 upstream and downstream levels and the position of the sluices at Aswan have been recorded daily, and by means of the calibration of these sluices, which has now been determined with a high degree of accuracy, the discharges in the earlier years have been calculated. Distribution at the Delta Barrage has been carried out since 1919 by the calibration method. In general the accuracy and system of record of the statistics are being continually improved, and they are now of a high order; and great reliance can, in particular, be placed on those of the last seven years.

Time Lag.

44. The great distances and the small slope of the river make the time of travel an important factor in any calculations regarding the Nile. This time of travel has to be borne in mind continually, and where reference is made to the date of some event at Sennar, for example, it is necessary to reckon the corresponding date on which the effect will be felt at Aswan, or the Delta Barrage, before the significance of that effect can be properly appreciated. Reference, in short, must be both by time and place. The lag, moreover, is not constant, but varies with the river stage.

45. At the request of the Commission the time lag between one point and another has been calculated by the Physical Department. The calculations are contained in Appendix B, from which it will be seen that the total time of travel from Sennar to the Delta Barrage at the critical times is estimated to be :—

In January–February = 34 days.
In July–August = 27 days.

Where necessary for the purpose of investigating special conditions, *i.e.*, low years, the lag taken into account has been specially calculated from the appropriate data.

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Losses.

46. "Nile Control" (page 248) estimated that 124 volumes of water passing Khartum are reduced by losses to 100 at Aswan. In gauging the effect on the river conditions in Egypt of any abstraction at Sennar the Commission does not feel that it is necessary or even possible to take these losses into account for the purposes of the present proposals. It prefers to assume that the full effect of any abstraction at Sennar will be felt in Egypt without any reduction. At some future time this factor may become more precisely known, and also more important, and it can then be taken into account if necessary.

Division of the Year.

47. As already explained, the basic idea underlying the Commission's proposals is the division of the year into two seasons, during one of which the Gezira Canal would take water from the natural river, whilst during the other its supply would be drawn from storage, leaving the natural river reserved to Egypt. In this respect the Commission is merely following the principles of "Nile Control," and of the Nile Projects Commission, but adopting other methods of studying the problem and of demonstrating the results. The examination of the conditions at the critical points where the supply of the rising river overtakes requirements and where, on the falling river, the reverse takes place, formed the most important part of the Commission's studies. The present Chapter is chiefly devoted to this examination, the presentation of its results, and the conclusions arrived at.

Rising River, July–August.

48. The conditions of the rising flood at the Delta Barrage are illustrated in Diagram No. 1 contained in Appendix C, which is based on the discharge passing down the river below the Delta Barrage. The river curves are those of the mean of 1912–25, the abnormally low year 1913, and of the year 1915, in which the conditions were, except for 1913, the worst of the series of fourteen years. The discharge used for irrigation below the barrage at this time of the year is taken into account; and the effect of the Sennar Dam, operated as provided in the table* on page 87 of "Nile Control," is shown with due allowance for the time lag, which, as already explained, varies with the stage of the flood.

49. It is seen from the diagram that in average years by the time the effect of withdrawals of water at the Sennar Dam is felt at the Delta Barrage the supply passing down the river branches amounts to nearly 150 million cubic metres daily, and that the effect is negligible under these conditions. In 1915 the effect would have been appreciable but not injurious. Under 1913 conditions the effect would have been to take water from the river about ten days in

* Reproduced as Appendix D.

advance of the establishment of the real rise of the flood. The conclusion to be drawn from this diagram is that, provided the rise of the river is not later than in 1915, the arrangement in "Nile Control" is quite suitable, whereby the Gezira Canal would begin on the 16th July to draw on the river at Sennar to the extent of the prescribed volumes. In years worse than 1915 some postponement of this date would be needed to avoid taking water actually required for irrigation in Egypt.

50. It was explained in paragraph 41 that the Commission would feel that, on general grounds, any proposal for reducing volumes already allotted to this scheme, and in respect of which commitments had already been entered into, would be outside its province. The question of postponing the opening of the canal for a few days in occasional years of a late rise of the river appears, however, to the Commission in a somewhat different light. At this time of the year the water is chiefly required in Egypt for the durra crop, which should be sown as early as possible if the best results are to be obtained. Similarly, in the Sudan Gezira, early sowing of the cotton is desired. It seems reasonable that in a year when the rise of the river is delayed, the Sudan should share with Egypt whatever disadvantages may attach to the late sowing of the crops.

51. The conditions of 1915 may be regarded as the worst conditions under which the "Nile Control" arrangement would be suitable; and those of 1913 as the worst likely to occur. A sliding-scale whereby the opening date would be postponed in proportion as the conditions fell short of those of 1915 would meet the requirements which the Commission has in view. Such a sliding-scale might be derived from the figures contained in Appendix E. It is seen that both in 1915 and in 1913, on the date when the Sudan could have begun to draw on the river, the combined discharge of the Blue and White Niles amounted to 142 million cubic metres a day; and that the mean discharge for the preceding five days was 135 millions a day. Adopting a figure of 160 millions to allow a margin, it could be arranged that the Gezira Canal should not draw on the natural river until a mean total discharge of 160 millions a day for five days is reached at Sennar and Malakal, allowing for ten days' lag in the case of the latter.

52. The Commission, whilst putting forward this proposal from considerations of equity, does not believe that in fact any appreciable harm would be done to Egyptian interests if the Sennar works were operated according to the "Nile Control" scheme, regardless of the character of the season. Moreover, as stated in an earlier paragraph, it is not in favour of introducing complications such as might be involved in the use of a sliding-scale. But in this case the criterion as to the character of the season is so direct, and the procedure so simple, that no difficulties should arise on the rare occasions when the sliding-scale would be called into play. The Commission accordingly recommends the adoption of this arrangement if the authorities concerned think it worth while to depart from the simplicity of a fixed date.

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Flood Season.

53. The rise of the river having, as already seen, become well established in the latter half of July, it has now to be seen what volumes, if any, could, consistently with the interests of Egypt, and the principles followed by the Commission, be taken in the Sudan, in addition to the volumes allowed for the present Gezira Scheme, as detailed in "Nile Control." Diagrams Nos. 2 to 4 show the volumes escaped into the sea under average conditions and in the two lowest years, 1915 and 1913, and the effect which will be produced by the Gezira Canal and the filling of the Sennar and Gebel Aulia Reservoirs. With regard to the latter reservoir, the Commission understands that the final details of a revised scheme have now been approved by the Ministry of Public Works, but the Commission is not aware of the exact particulars. The filling as shown on the diagram is an assumption made by the Commission with the object, chiefly, of showing the proportion which the capacity of this reservoir bears to the volumes available at this season. The water of the White Nile being free of silt, the filling of this reservoir, unlike that of Aswan or Sennar, can be carried out at any time.

54. Although there is seen to be a large volume of unused water at this season, the Commission felt that any additional water allotted to the Sudan should, for two reasons, be on a moderate scale. In the first place, the losses in the new reservoirs at Sennar and Gebel Aulia are at present a doubtful factor, and will only become known accurately when the works have been in operation for a year of two. In the second place, there is the question of levels as affecting the basins in Upper Egypt, to which the Commission has given careful consideration. Appendix F has been prepared to show the effect at Aswan of the withdrawal of volumes of 100, 150 and 200 cubic metres a second during the low floods of 1911, 1913, 1915 and 1918. No calculations have been made as to the effect of the filling of the Gebel Aulia Reservoir in its revised form, but it is clear that this reservoir must have a much greater influence on the levels in Egypt than the abstractions at Sennar now contemplated.

55. An important consideration bearing on this question is that, judging by the results of the pumping schemes, the irrigation requirements of the Gezira Canal will not be at their maximum in August and September, the season when the flood is at its maximum. The cotton crop is sown in the Sudan in the latter part of July and the early part of August, and, owing to rainfall at this season, the second watering is not required till the latter part of September, the food crop meanwhile being sown after the cotton. Consequently, whatever maximum discharge may be fixed for the Gezira Canal in flood time, it will, in fact, be taking a reduced discharge at the time of the basin filling in Egypt.

56. It has always been recognised that a lowering of levels in Upper Egypt, with consequent increased difficulty of filling the basins, must result from the working of the Gebel Aulia and

Gezira schemes. The basins in the Sudan will be similarly affected. The present Commission is not disposed to enter into an argument on general principles as to how far the maintenance of levels can be regarded as an established right.

Approaching the matter as a body of engineers invited to advise on a practical question, the Commission considers that development or conservation works in the upper part of the river should not be indefinitely restricted by considerations of the natural levels lower down, but that the Sudan should accept a limited rate of progress, so as to afford Egypt the opportunity to overtake the effect of development in the Sudan by construction of the works which formed her part of the original programme.

57. Subject to the above proviso, the Commission finds that from the 1st August the additional volumes shown in the following table could be taken at Sennar in flood time. The 1st August at Sennar corresponds to about the 25th August at the Delta Barrage, a date by which the flood is well established in its rise, and the Delta Canals have attained their full supply levels. It further recommends that the additional volume should be taken progressively on a scale not exceeding that in the following table :—

	Maximum Discharges in Cubic Metres per second.		
Year.	Already sanctioned for initial Scheme.	Proposed Addition.	Total.
1925–26	84	...	84
1926–27	84	...	84
1927–28	84	...	84
1928–29	84	...	84
1929–30	84	12	96
1930–31	84	24	108
1931–32	84	36	120
1932–33	84	48	132
1933–34	84	60	144
1934–35	84	72	156
1935–36	84	84	168

NOTE.—The maximum discharge is 84 cubic metres a second in August, September, October and November; and 80 cubic metres a second in December.

58. The Commission finds that in a year like 1913 the final filling of the Sennar Reservoir might have to be modified from the "Nile Control" programme if the additional discharge now proposed is taken by the canal. In all such years the programme of filling Aswan is carefully considered and adapted to the conditions prevailing. The Commission foresees no difficulty in the application of the same methods to the relatively small volume required for the Sennar Reservoir, and does not think it necessary to make any specific proposals in a matter which is best left for the authorities concerned to deal with if and when the need arises.

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Falling River. January–February.

59. The Commission devoted much time to considering whether the 18th January could be taken as correctly marking the cessation of surplus in the river. Appendix G, with its accompanying statement of dates, gives an attempt to arrive at the correct date, employing as criteria the demands of the canals, the gradual shrinkage of the volumes passing the Delta Barrage and the closing of the sadds, or earth banks, at the river mouths.

60. The earlier years may be discarded as unreliable or inapplicable to present conditions. The year 1917–18 was entirely abnormal, as the river remained in flood all through the summer. Taking the remaining years in two groups, there ceased to be any excess water on the following mean dates :—

	Delta Barrage.	Corresponding Date at Sennar.
1910–17	February 21	January 18
1919–25	February 11	January 8

Thus the earlier group of years representing the conditions obtaining when the Gezira Scheme was being planned gives, by the method now employed, the same date at Sennar as was actually adopted by the framers of the scheme, namely, the 18th January. On the other hand, according to the data of the more recent years, the date would be the 8th January.

61. By way of further study of this question, the Commission invited Dr. Hurst, Director-General of the Physical Department, and Mr. Butcher, Director of the Delta Barrage, to investigate separately, and by whatever method seemed to them most appropriate, the conditions at this season of the year. They were asked firstly to test the correctness of the "Nile Control" date of the 18th January, and, secondly, assuming that the Gebel Aulia Dam had come into operation, to ascertain up to what date the surplus still remaining would permit of the Gezira Scheme being allowed the additional volume found by the Commission to be available during the flood season. The object in making the assumption that the Gebel Aulia Dam was actually in operation was to give effect to the view expressed in paragraph 40, *i.e.*, to ensure that there should be sufficient water for the Gebel Aulia Dam and the resulting development of irrigation in Egypt before any further allotment of water were made for the Gezira.

62. Dr. Hurst based his study on the figures of 1920, which, for the month of February, was the lowest of the six years 1919–20 to 1924–25. The method adopted and the results arrived at are set out in Appendix H and its accompanying Diagram No. 5. The conclusion arrived at is that under existing conditions, *i.e.*, ignoring the Gebel Aulia Reservoir, the Gezira Canal could be given the "Nile Control" volumes up to the 23rd February, Delta Barrage date, corresponding to the 20th January at Sennar. Taking Gebel Aulia into account without the losses in the reservoir, the date would be the 12th January at Sennar, while, allowing for these

losses, the date would be the 8th January. As regards the additional water for the Gezira, it was found that, ignoring the losses, the proposed additional supply could be taken up to the 1st January at Sennar, and, with losses taken into account, up to the 28th December.

63. Mr. Butcher employed a different method, explained in the note in Appendix J, based on the average of the six years 1918–19 to 1923–24, for which period the records, as already mentioned, are exceptionally detailed and reliable. It is important to know how these six years compare with the mean of a longer cycle; and Appendix J shows that the mean supply in December and January of these years represents 91 per cent. of the corresponding mean of the last twenty years, and that all six years are below the average of the twenty years. The Commission regards these years as affording a suitable basis of calculation.

64. Nothing was known to the Commission of the manner in which the additional storage water of the Gebel Aulia Reservoir would eventually be employed. Mr. Butcher, finding that the storage amounted to an addition of about 22 per cent. to Egypt's supplies during the summer season, assumed that a corresponding expansion would take place in the demands for water at other seasons of the year. It is doubtful if such a result would actually occur, but the effect of this assumption on the calculations is certainly favourable to Egypt. Assuming the Sennar and Gebel Aulia Reservoirs to be both in operation, there would, according to the Diagram No. 6 employed in this calculation, be sufficient water to meet all requirements in full up to the 10th February corresponding to the 7th January at Sennar, after which there would still remain available a volume of 140 millions now running into the sea.

65. The diagram shows the effect of the further abstraction of 80 cubic metres a second after providing for the Gezira Canal on the "Nile Control" basis, and the expansion of cultivation in Egypt following the construction of the Gebel Aulia Reservoir. It will be seen that the additional volume can be abstracted up to the 5th February at the Delta Barrage, corresponding to the 2nd January at Sennar, without taking water now in use for existing cultivation, and leaving a discharge of 75 million cubic metres a day for navigation requirements during the annual closure of the canals in Egypt.

66. As another means of exhibiting graphically the conditions at this season of the year, and their relation in time to conditions at Sennar, Diagram No. 7 was prepared. This shows the daily discharges of the two branches in January and February in the four lowest years, 1913, 1916, 1920 and 1922. The volumes being stored at Aswan at the same time are also plotted on the diagram, which therefore gives a fairly complete representation of conditions at this season. The Sennar dates, the 31st December and the 18th January, are also shown on the diagram, the appropriate lag being employed.

67. It will be seen that the calculations referred to in para-

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graph 60, so far as the earlier years are concerned, and Dr. Hurst's first calculation, both tend to confirm the arrangement by which the Gezira Canal was planned to draw on the river up till the 18th January. These calculations ignore the effect of the Gebel Aulia Reservoir, whilst the view expressed in paragraph 40, that no special priority should be given to the Gezira Scheme, would require that account be taken of both schemes. Taking both into account, the date given by Dr. Hurst's calculations is the 8th January. Although the Commission takes the view stated as to priority, it is not prepared to argue that such a view should be applied retrospectively, and that the basis of a completed scheme should necessarily be changed as the result of the adoption of a new principle, new data and new methods of calculation.

68. Turning now to Mr. Butcher's calculations, attention must be drawn to the importance of the factor introduced by the closing of the sadds on the river branches at this time of the year. This operation requires the use of considerable volumes of water in order to maintain a sufficient flow through the gap in the uncompleted sadd to prevent the entry of sea water into the river. The closing is carried out under present conditions in February in most years, but, with the coming into operation of the Gezira Scheme and the Gebel Aulia Reservoir, the resulting increased draw on the river will be such that, unless the sadds are closed earlier than at present, the water necessary to exclude the salt must be taken from storage.

69. With an earlier closing of the mouths of the river the water used under present conditions for excluding sea water will become part of the irrigation supply at this season. It is, in fact, included in the volume of 140 millions referred to in paragraph 64 as available after the date when a shortage would first be felt, namely, the 7th January, at Sennar. Now, according to the scale provided in "Nile Control" the Gezira Scheme would draw from the river a volume of 69 millions, or almost exactly one-half of the available 140 millions. Thus, with the change in the time of closing the sadds, which, according to Mr. Butcher's forecast, must take place with expansion of irrigation, the first instalment of the Gezira Scheme, though drawing its supply from the river till the 18th January, would not be taking water at present used for irrigation in Egypt. In this calculation the Commission sees confirmation for the view that, as far as the present Gezira Scheme is concerned, no change need be proposed in the original date the 18th January.

70. As regards the date up to which the additional supply could be taken, the results of the two investigations agree fairly well, being in the one case the 28th December and in the other the 2nd January (Sennar dates). The Commission recommends that the additional water be taken till the 31st December. It is important to explain at this point that for purposes of silt clearance and other works, the canals in Egypt are closed every year towards the end of December and reopened in the early part of February, the actual dates of reopening of the different canal systems depending on the completion of the closure works. This closure is an annual necessity and it must always take place at this season, as climatic conditions

render it impossible at any other. It therefore forms an important feature of the irrigation year in Egypt. It is the reopening of the canals after this closure which accounts for the rapid disappearance of surplus water in Egypt in February and the fact that the shortage occurs at a fairly constant date every year. The effect of the Commission's recommendation in this paragraph is therefore that the Gezira Canal should not take any additional water from the river after the time corresponding to the reopening of the canals in Egypt.

71. The arrangement by which the Gezira Canal would draw the volumes provided in "Nile Control" from the natural river to the 18th January, but would take no extra water after the 31st December, may perhaps be made clearer if the extent to which the Sudan may draw upon the river in January is expressed in terms of total volumes without the use of the date the 18th January. The volume provided in "Nile Control" is 117 million cubic metres up to the 18th January, and the Commission's proposal is that no more than this should be taken in January. As explained in paragraph 49, the Sudan will not again draw on the natural river till the 16th July. Thus from the 1st January to the 15th July the Sudan will only take from the natural river, exclusive of the comparatively small volumes for pumps, a volume of 117 million cubic metres. At this period of the year Egypt will have practically all the remainder of the natural flow amounting, from the figures in Appendix K, to about 13,000 million cubic metres, as well as the volumes stored at Aswan and Gebel Aulia. Viewed in this light, the question of the precise date in January up to which the Sudan should draw the "Nile Control" volumes of 4·5 million cubic metres a day from the river is seen to be a matter of relatively minor importance from the point of view of the water supply of Egypt. On the other hand, it would be of real importance to the Sudan, whose resources during the low-river season would amount to no more than the contents of the Sennar Reservoir, *i.e.*, something of the order of 500 million cubic metres, with rights in the natural river limited to the above volume of 117 millions and the small volume for the pumps.

72. The Commission carefully considered whether it should propose any special provisions for dealing with abnormally low years, such as 1913–14. It was aware that in such a year, with the Gezira Scheme drawing on the natural river up to the 18th January, the Sudan would, on the method of calculation employed in this Report, be drawing to some extent on water not actually surplus to Egyptian requirements. In order to deal specially with such years it would be necessary to adopt some criterion or index by which abnormal conditions would be defined, a sliding-scale to regulate the amount of water to be taken by the Sudan in these years, and a method of forecasting these conditions some time in advance of their actual occurrence.

73. Various arrangements were thought of and discussed with the Physical Department. Finally, the Commission decided that, in view of the relative insignificance of the volumes involved, the rarity of abnormally low years, and the fact that the Egyptian Government has now definitely embarked on a policy of developing

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the latent resources of the river, it would be of doubtful utility to propose special arrangements which would involve elaborate forecasting, would open the door to misunderstanding and friction, and which might never be needed. On the facts themselves and on the general grounds set out in paragraph 41, the Commission would not propose any change in the original plan by which the volumes originally provided for the Gezira Canal in "Nile Control" may be taken from the natural river up to the 18th January.

74. As regards the additional water, however, the considerations in paragraph 41 do not apply and the Commission felt that its proposals must take into account the occurrence of low years, even if this involved the inconvenience of a sliding-scale. Owing to the winter closure of canals in Egypt, there is an important difference between the use of water at Sennar in the first eighteen days of January and its use in December. For whereas water taken in January might affect irrigation supply in Egypt, that taken in December would only be felt in Egypt during the time of closure of the canals, during which period the river is in flow to the sea, and navigation is the only interest involved. Thus, in considering a sliding-scale for regulating the date at which the additional water should cease to be drawn from the river, the test to be applied is the effect of the proposed abstraction of water upon navigation facilities in Egypt.

75. There is no absolute figure of discharge which can be adopted as the minimum required for navigation at any time. In "Nile Control" a figure of 1,500 to 2,000 millions downstream Aswan is mentioned as being required in January for navigation; and, in the minority recommendation of the Nile Projects Commission, the figure of 1,500 millions was proposed. As mentioned in paragraph 65, the arrangement proposed in this Report would provide a discharge of 75 millions a day, or 2,300 during the month, under conditions somewhat below average. It would not be possible to fix such a discharge as an absolute minimum even for the worst years, since in January 1914 the discharge is seen (Diagram No. 7) to have fallen to 40 millions a day, and even less, at the Delta Barrage.

76. An arrangement arrived at by another line of argument was considered by the Commission. The natural river is seen from Diagram No. 6 to be falling at a mean daily rate of about 1 million cubic metres a day at the end of January at the Barrage, corresponding to the end of December at Sennar. The total volume now proposed to be abstracted at Sennar in December is approximately 14 millions a day. Thus, whatever conditions would have occurred in Egypt in previous years would, under the new conditions, occur about fourteen days earlier. A possible arrangement would be to have a sliding-scale by which, according to the character of the season, the date for ceasing to take the extra water would be advanced until, under 1913–14 conditions, it would be the 18th December instead of the 31st December as in ordinary years.

77. As an index of the character of the year, the total natural river as at Aswan in the month of December may be employed.

To determine the conditions to which the 31st December would be applicable, there is the calculation referred to in paragraph 62, indicating that in 1919–20 the date should have been the 28th December, and the calculation referred to in paragraph 65, indicating the 2nd January. Now, in 1919–20, the total December flow is seen (Appendix J) to have amounted to 4,410 millions, whilst in the six years employed for the second calculation it averaged 4,860 millions. From this it appears that a total of about 4,700 millions would be a suitable zero for the sliding-scale. At the other end of the scale is the 1913–14 figure of 2,800 millions. On this basis the sliding-scale would take the following simple form: The date up to which the Sudan will take the additional volume of 80 cubic metres a second will be the 31st December in all years in which the total natural river at Aswan in December is not less than 4,700 million cubic metres; and it will be earlier in low years at the rate of three days for every 400 millions by which the actual total December natural river in any year falls short of 4,700 millions.

78. This scale may have the appearance of being somewhat of an approximation, but it is devised from the data available upon the only basis which is applicable at this season of the year, namely, navigation needs, which do not lend themselves to accurate definition. It is in accordance with recorded facts, and it serves the purpose which the Commission has in mind, adjusting the Sudan's supply in accordance with the vicissitudes of the season, from which neither party can reasonably enjoy immunity. In practice the Sudan would be obliged to go on drawing from the river until the end of December, and to make good the overdraft later on when the criterion of the year had been determined.

79. There are two outstanding objections to a sliding-scale on the lines proposed. In the first place, any such arrangement opens the door to possible differences of opinion as to the figures upon which it depends; and it may well be that a fixed date, with its immunity from the possibility of dispute, is preferable to an arrangement theoretically desirable, but liable in practice to lead to friction between the authorities who will have to work it. In the second place, and accentuating the above objection, the suggested scale depends upon the natural river at Aswan, and, with two more reservoirs in operation above this point, the computation of the natural river at Aswan must become a difficult matter, involving a number of doubtful factors. It is, however, the best that the Commission can devise which will serve the purpose in view, namely, to ensure that the working of the Gezira Canal is, so far as extensions are concerned, adjusted to suit the conditions of low years.

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CHAPTER IV.

Pump and Basin Irrigation in the Sudan.

80. As pointed out in an earlier paragraph, the areas in the Sudan under pump and basin irrigation are on a small scale, and therefore relatively unimportant as factors in the situation. Nevertheless, important considerations are involved, and the Commission has devoted considerable thought in particular to the question of pump irrigation.

Pump Irrigation.

81. Prior to 1904 pumps had been licensed in the Sudan, with the approval of the Egyptian authorities, to the extent of about 2,000 feddans of perennial irrigation. On the completion of the Aswan Dam in that year an increase of 10,000 feddans was approved, to which was added, on the raising of the dam in 1912, a further 10,000 feddans. The approved area of perennial pump irrigation is therefore about 22,000 feddans. There is some doubt as to the total area authorised to receive perennial pumping, some of the records tending to show that the 10,000 feddans approved on the completion of the Aswan Dam included the area previously licensed, whilst others tend to show that the 10,000 feddans was for new licences. The difference is not of great importance, but the Commission is of opinion that the matter should be cleared up by the authorities concerned so as to avoid future misunderstanding.

82. The British delegate suggested that the two Governments concerned might be prepared to agree that, following the above analogy, the area of perennial pumping in the Sudan should be increased by 20,000 feddans on the completion of the Gebel Aulia Dam. This is not, however, a technical point, and it goes somewhat beyond the scope of this Report, as defined in earlier paragraphs; for it raises the question whether the Sudan should be held entitled, by virtue merely of its geographical position, to draw on the river at a time when there is no surplus.

83. It should be noted that perennial pumping must involve taking water during the low stage of the river, and although in practice the actual area under irrigation in the summer has so far always been much less than the sanctioned area, the above suggestion would permit the Sudan to draw on water which is at present beneficially used by Egypt. However, in view of the relative unimportance of the volumes that would actually be drawn from the river during its low stage by a limited expansion of perennial pumping, the Commission feels that the Governments should have no difficulty in settling this question without the intervention of a technical body, and it accordingly refrains from making a definite recommendation.

84. In addition to the above perennial irrigation, the Sudan was authorised in 1905, under an order of the Egyptian Ministry of Public Works, to pump without restriction of area from the

15th July to the end of February (Sudan dates). This authority has, so far, been utilised to the extent of about 16,000 feddans. The investigations of present conditions, as set out in this Report, indicate that the flood season, to which this permit was intended to apply, cannot be said to extend beyond the end of December (Sennar); and, therefore, in accordance with the principles adopted by the Commission, flood pumping should, in the case of any new areas, cease at this date. Agricultural conditions, however, are such that pumping under these conditions would have little value. Consequently, it becomes necessary to consider how non-perennial pumping in the Sudan can be regulated in the future consistently with the principles of this Report, and under present conditions of supply in the river.

85. A solution which suggests itself is that the water consumed after the end of December on any new areas of non-perennial pumping should be compensated for by the release of storage water from the Sennar Reservoir. A change in the method of working the reservoir would make available an additional volume, not taken into account in the calculations for the Gezira Irrigation Scheme, which could be utilised for this purpose. The original plan for working the Gezira Canal, as explained in an earlier part of this report, was that from the 15th April till the 15th July the canal should remain in flow with a discharge drawn from the reservoir estimated as being necessary for domestic purposes throughout the irrigated tract. Under this arrangement the reservoir would naturally have to be kept up to the level required to give this supply. Owing to the relative levels of the canal and the natural river, a volume estimated at about 150 million cubic metres would, under these conditions, remain permanently impounded in the reservoir. If the domestic water supply were raised by pumps, it would be possible to release this volume, and thus return to the river any volumes required to compensate for the water abstracted by pumps after the close of the flood season, *i.e.*, end of December (Sennar).

86. This volume must be again taken from the river in July before the canal can be brought into operation for the following season; and Diagram No. 1 shows that, in a year of average or high flood, no serious effect would be produced on conditions in Egypt at the corresponding dates. In a year of very late flood the programme of filling of Sennar Dam can be retarded, in accordance with the arrangement proposed in paragraph 51, so as to reduce to a negligible quantity the effect of the above extraction. This should not present any difficulty to the authorities concerned, and the Commission feels that the occasional occurrence of very exceptional conditions should not be regarded as precluding the adoption of measures suitable under ordinary conditions, and not impracticable even under bad conditions. The Commission is of opinion therefore that permits for flood pumps working to the end of February can therefore continue to expand gradually as in the past, so long as any water pumped after the end of December can be compensated for in the manner explained above.

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Basin Irrigation in the Sudan.

87. There are areas of basin land in the Sudan totalling about 80,000 feddans, of which, however, only a small part is annually flooded. These basins are, it is understood, not capable of much improvement, and are of no great agricultural value. The land is high and the conditions seem to be such that they cannot be filled from canals taking off at a distance upstream, as is the case in Egypt. They will suffer to some extent from the abstraction of water at Sennar and Gebel Aulia, but the arguments employed in connexion with the basins of Upper Egypt apply here also. The Commission does not regard this question of basin irrigation in the Sudan as an important factor in the problem before it, and sees no need to make any special recommendations in this connexion.

CHAPTER V.

Summary and Conclusion.

Summary.

88. The Commission's main findings may be summarised as follows :—

(i.) The natural flow of the river should be reserved for the benefit of Egypt from the 19th January to the 15th July (at Sennar), subject to the pumping in the Sudan as defined below.

(ii.) The Gezira Canal may begin to draw on the natural flow of the river on the 16th July, the canal being gradually raised to full supply level by the 31st July, according to the scale fixed in "Nile Control," contained in Appendix D, provided that a mean total discharge of 160 million cubic metres a day must have been reached at Sennar and Malakal during the preceding five days, allowing for ten days lag in the case of the latter.

(iii.) From the 1st August to the 31st December the Gezira Canal may, subject to the progressive scale laid down in paragraph 57 of this Report, draw the following volumes from the river :—

The 1st August to 30th November, 168 cubic metres a second.

The 1st to 31st December, 160 cubic metres a second, provided that, in any year in which the total flow of the natural river in December as at Aswan is less than 4,700 million cubic metres, 80 cubic metres a second shall be taken from the natural river during the whole of December, and the balance shall be taken from the natural river up to a date preceding the end of the month by three days for every 400 million cubic metres by which the actual total December natural river in that year falls short of 4,700 million cubic metres.

(iv.) The Gezira Canal may not draw during the month of January more than the volumes provided in "Nile Control," *i.e.*, 80 cubic metres a second from the 1st to 15th, and 52 cubic metres a second from the 16th to 18th, a total of 117 million cubic metres.

(v.) The final filling of the Sennar Reservoir from the level required to give full supply in the canal to the full storage level of the reservoir should be carried out in November, as provided in "Nile Control."

(vi.) Any further flood pumping carried out in the Sudan up to the end of February should be considered as drawing its supply from the Sennar Reservoir after the 31st December. In other words, a volume equal to that consumed on these areas after the 31st December, according to ascertained data, should be discharged from the reservoir as compensation to Egypt, and the Sennar Reservoir should be worked so as to provide the additional storage required to cover the compensation volumes as above.

(vii.) After the end of February only perennial pumping, as referred to in paragraph 81, should be carried out in the Sudan.

Conclusion.

89. The Commission foresees that it will be necessary from time to time to review the questions discussed in this Report. It regards it as essential that all established irrigation should be respected in any future review of the question. In particular, the Sudan should only take from the natural river in January, exclusive of pumping rights as now existing, the "Nile Control" volume of 117 million cubic metres. All other requirements till July should be provided by the Sudan from storage or other conservation works.

90. The Commission has been impressed by the fact that future development in Egypt may require the construction of works in the Sudan and neighbouring territories, such as Uganda, Kenya and Tanganyika, and it feels that Egypt should be able to count on receiving all assistance from the administrative authorities in the Sudan in respect of schemes undertaken in the Sudan, as well as from the British Government in any questions concerning the neighbouring territories.

91. The Commission has endeavoured to find a practical and workable basis for irrigation, and to foresee, and, as far as possible, to provide for, any difficulties that may arise in the future. But it is aware that doubtful points may well arise in the interpretation of any document, and that differences of opinion as to fact cannot fail to occur from time to time in such matters as the volumes of water flowing in a river or canal, discharged through sluices, or lost by evaporation or seepage. It does not feel called upon to make proposals with regard to special arrangements for dealing with such doubts and differences, which seem to be outside the sphere of a

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technical commission. It does, however, desire to record emphatically the view that neither the elaborate drafting of an agreement nor the provision of special machinery for adjudication should be allowed to obscure the importance of mutual confidence and co-operation in all matters concerning the river and its waters.

92. Finally, the Commission desires to draw attention to the very great importance of continued study of the river and systematic record of the statistics. A very good hydrological organisation has been built up, and its continued efficiency is absolutely essential, not only to fresh development work, but also to the correct working of the arrangements proposed in this Report, or, indeed, of any other arrangements that could be devised.

ABDUL HAMID SOLIMAN,
Egyptian Delegate.

R. M. MacGREGOR,
British Delegate.

Cairo, March 21, 1926.

APPENDIX A.

NOTES EXCHANGED.

Ziwer Pasha to Lord Allenby.

Excellence, *Le Caire, 26 janvier 1925.*

DANS la note du 22 novembre 1924 que votre Excellence a adressée à mon prédécesseur de la part du Gouvernement de Sa Majesté britannique, elle a demandé que la superficie du terrain à irriguer à la Guézireh au Soudan soit portée du chiffre de 300,000 feddans jusqu'à un chiffre illimité.

A cette note mon prédécesseur a répondu par une note en date du 23 novembre dans laquelle il a déclaré que la question de modifier d'ores et déjà la limite fixée pour la superficie à irriguer dans la Guézireh était pour le moins prématurée et devrait, d'après les déclarations répétées du Gouvernement de Sa Majesté britannique, être résolue de commun accord en tenant compte des intérêts vitaux de l'agriculture égyptienne.

Comme conséquence de cette réponse votre Excellence a informé le Gouvernement égyptien d'alors par une note portant la même date que des instructions avaient été données au Gouvernement soudanais dans le sens qu'il était libre à l'avenir d'irriguer à la Guézireh une superficie de terrain illimitée.

Maintenant que les relations cordiales ont été heureusement rétablies entre nos deux pays il est de mon devoir d'attirer l'attention de votre Excellence sur le fait que la mesure annoncée dans sa note du 23 novembre a soulevé dans ce pays les plus graves inquiétudes. Votre Excellence sait, d'ailleurs, que dans toutes les discussions qui ont eu lieu entre les deux Gouvernements par le passé pour tomber d'accord sur le régime des eaux du Nil, et, en particulier, au sujet du développement de l'irrigation au Soudan, le Gouvernement égyptien a toujours fermement revendiqué ses droits aux eaux du Nil.

Le Gouvernement égyptien a toujours soutenu que ce développement ne doit en aucun cas être de nature à nuire à l'irrigation de l'Egypte ni à porter préjudice aux projets éventuels tellement nécessaires pour subvenir aux besoins de la population agricole si rapidement croissante de ce pays. Et je ne crois pas me tromper en affirmant que ce principe essentiel à la vie de l'Égypte a été pleinement admis par le Gouvernement de Sa Majesté britannique.

Je viens donc prier votre Excellence de bien vouloir reprendre en considération la question de l'irrigation de la Guézireh et de revenir sur les instructions dont il est parlé dans la note susmentionnée du 23 novembre 1924, une telle mesure ne pouvant que raffermir les bonnes relations entre nos deux pays.

Je saisis, &c.

Le Président du Conseil des Ministres,
Ministre des Affaires étrangères,
A. ZIWER.

(Translation.)

Your Excellency, *Cairo, January 26, 1925.*

IN the note which your Excellency, on behalf of His Britannic Majesty's Government, addressed to my predecessor on the 22nd November, 1924, you asked that the area of land to be irrigated in the Sudan Gezira should be increased from 300,000 feddans to an unlimited extent.

To this note my predecessor replied in a note of the 23rd November, in which he declared that the question of immediately modifying the limit fixed for the area to be irrigated in the Gezira was, to say the least, premature and should, in accordance with the repeated declarations of His Britannic Majesty's Government, be settled by mutual agreement, taking into consideration the vital interests of Egyptian agriculture.

In view of this reply your Excellency then informed the Egyptian Government, in a note of the same date, that instructions had been given to the Sudan Government to the effect that it was free in future to irrigate an unlimited extent of land in the Gezira.

Now that friendly relations have happily been re-established between our two countries, it is my duty to draw your Excellency's attention to the fact

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that the measure announced in your note of the 23rd November has raised the most serious apprehensions in this country. Further, your Excellency is aware that in all the discussions which have taken place in the past between the two Governments with a view to reaching an agreement as to the control of the waters of the Nile, and in particular on the subject of the development of irrigation in the Sudan, the Egyptian Government has always firmly asserted its rights in the waters of the Nile.

The Egyptian Government has always maintained that this development should in no case be of such a nature as to be harmful to the irrigation of Egypt or to prejudice future projects, so necessary to meet the needs of the rapidly increasing agricultural population of this country. I do not think I am wrong in asserting that this principle, vital to Egypt, has been fully admitted by His Britannic Majesty's Government.

I have, therefore, to request your Excellency to be so good as to reconsider the question of the irrigation of the Gezira and to withdraw the instructions referred to in the above-mentioned note of the 23rd November, 1924, since such a measure could only serve to strengthen the good relations between our two countries.

I avail, &c.
A. ZIWER,
President of the Council of Ministers,
Minister for Foreign Affairs.

Lord Allenby to Ziwer Pasha.

Sir, *Cairo, January* 26, 1925.

I HAVE the honour to acknowledge the receipt of the note which your Excellency was good enough to address to me to-day asking me to reconsider the question of the irrigation of the Gezira and to revoke the instructions mentioned in the note which I addressed to your Excellency's predecessor on the 23rd November, 1924.

2. His Majesty's Government appreciate the sincerity of the friendly feelings expressed by your Excellency and fully share your desire to restore and strengthen the good relations between our two countries which have been so unhappily disturbed.

3. I am therefore glad to be able to inform your Excellency that I am now in a position to impart to you the views of my Government on this subject.

4. I need not remind your Excellency that for forty years the British Government watched over the development of the agricultural well-being of Egypt, and I would assure your Excellency at once that the British Government, however solicitous for the prosperity of the Sudan, have no intention of trespassing upon the natural and historic rights of Egypt in the waters of the Nile, which they recognise to-day no less than in the past, and in giving the instructions in question to the Sudan Government His Majesty's Government intended that they should be interpreted in this sense.

5. Moved by these considerations and in proof of their intentions, His Majesty's Government are disposed to direct the Government of the Sudan not to give effect to the previous instructions in regard to the unlimited development of the Sudan Gezira mentioned in the note of the 23rd November, on the understanding that an expert committee composed of Mr. J. J. Canter Cremers, Chairman, who has been chosen by agreement between the two Governments, Mr. R. M. MacGregor, British Delegate, and Abdel Hamid Soliman Pasha, Egyptian Delegate, who has been selected by the Egyptian Government, shall meet not later than the 15th February, 1925, for the purpose of examining and proposing the basis on which irrigation can be carried out with full consideration of the interests of Egypt and without detriment to her natural and historic rights.

6. It is understood that the Committee will present its report by the 30th June, 1925.

I avail, &c.
ALLENBY, *F.M.*,
High Commissioner.

APPENDIX B.

Time Taken for Changes of River Level at Sennar to Reach Delta Barrage.

Method of Determination.

Characteristic points on the gauge diagram at Makwar were traced to the gauge diagram of Khartum gauge. The number of days for the points to reach Khartum depends upon the level of the river. The number of days was therefore plotted against the gauge reading at Makwar and a mean curve drawn through the points.

The lag for a given date is obtained by reading from this curve the lag corresponding to the gauge on that date. This is the only practicable method which can be employed.

The same method has been adopted for the reaches Tamaniat to Wadi Halfa, Wadi Halfa to Aswan and Aswan to El-Leisi, and the lag in the different reaches added together to make the total lag.

One day was added for the lag from El-Leisi to Delta Barrage and 0·7 day for the lag from Khartum to Tamaniat.

This method, using the curves obtained by Dr. Phillips, was checked by Dr. Hurst for the early part of January at Makwar. Dr. Hurst used similar methods, but traced the characteristic points over different stretches of the river.

The following are the results obtained :—

	Days.
Dr. Hurst, First Method—	
Makwar, date (approximate) January 6–15, mean gauge (1919–24) 6·00, lag to Soba...	4·9
Soba, date (approximate) January 11–20, mean gauge Khartum 10·94, lag to Tamaniat	·8
Tamaniat, date January 12–21, mean gauge 10·64, lag to Atbara	3·1
Atbara, date January 16–25, mean gauge 10·47, lag to Halfa ...	10·6
	19·4
Dr. Hurst, Second Method—	
Makwar, date January 6–15, mean gauge 6·00, lag to Khartum...	5·3
Khartum, date January 11–20, mean gauge 10·94, lag to Halfa...	14·9
	20·2
Dr. Phillips—	
Makwar, date January 6–15, mean gauge 6·00, lag to Khartum...	5·7
Assumed, Soba to Tamaniat	1·0
Tamaniat, date January 13–22, gauge 10·61, lag to Halfa... ...	14·7
	21·4
Halfa, date January 28–February 6, gauge 2·12, lag to Aswan ...	3·5
Collecting Results—	
Makwar to Khartum—	
Dr. Hurst (1)	5·3
Dr. Hurst (2)	5·3
Dr. Phillips	5·7
Mean	5·4
Khartum to Halfa—	
Dr. Hurst (1)	14·1
Dr. Hurst (2)	14·9
Dr. Phillips	15·7
Mr. Watt	15·5
Mean	15·0

Contd 22 pages to go

EXCHANGE OF NOTES CONSTITUTING AN AGREEMENT

BETWEEN

THE GOVERNMENT OF THE UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND

AND

THE GOVERNMENT OF EGYPT

REGARDING

THE CONSTRUCTION OF THE OWEN FALLS DAM, UGANDA.

CAIRO, 30 AND 31 MAY 1949.

Title: Exchanges of Notes...regarding the construction of the Owen falls Dam, Uganda
Parties: Great Britain, Egypt
Basin: Nile
Date: 05/31/1949

No. 3122. EXCHANGE OF NOTES CONSTITUTING AN AGREEMENT[1] BETWEEN THE GOVERNMENT OF THE UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND AND THE GOVERNMENT OF EGYPT REGARDING THE CONSTRUCTION OF THE OWEN FALLS DAM, UGANDA. CAIRO, 30 AND 31 MAY 1949.

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I

His Majesty's Ambassador at Cairo to the Egyptian Minister for Foreign Affairs
ad interim

BRITISH EMBASSY

Cairo, 30th May, 1949

Monsieur le President du Conseil,

I have the honour to recapitulate below the points on which His Majesty Government in the United Kingdom and the Royal Egyptian Government have reached agreement concerning the construction and administration the dam to be erected at Owen Falls in Uganda:

"The Royal Egyptian Government and His Britannic Majesty Government in accordance with the spirit of the Nile Waters Agreement 1929,[2] have agreed to the construction of a dam at Owen Falls in Uganda for the production of hydro-electric power and for the control of the Nile.

"2. Plans and specifications for this work have been prepared consultation between and approved by the Egyptian Ministry of the Works and Uganda authorities. The Royal Egyptian Government, His Britannic Majesty's Government have accordingly agreed to the Uganda Electricity Board the issue of an invitation for the placing of contracts in agreement with these plans and specifics.

"3. The contracts will be submitted to the two Governments who examine them promptly and indicate their joint approval of them by the Notes exchanged between each other and notify at once the Government of Uganda.

"4. The two Governments have also agreed that though the construction of the dam will be the responsibility of the Uganda Electricity Board, the interests of Egypt will, during the period of construction represented at the site by an Egyptian resident engineer of suitable and his staff stationed there for the purpose by the Royal Egyptian Government, to whom all facilities will be given for the accomplishment of their duties. Furthermore, the two Governments have agreed that although the dam when constructed will be administered and maintained by the Uganda Electricity Board, the latter will regulate the discharges to be passed through the dam on the instructions of the Egyptian resident engineer be stationed with his staff at the dam by the Royal Egyptian Government for this purpose in accordance with arrangements to be agreed between the

Egyptian Ministry of Public Works and the Uganda authorities pursuant to the provisions of agreement to be concluded between the Governments.

"5. The two Governments also recognise that during and after the construction of the dam, the Uganda Electricity Board may take action at Owen Falls which it may consider desirable provided that the action does not entail any prejudice to the interests of Egypt in accordance with the Nile Waters Agreement of 1929 and does not adversely the discharges of water to be passed through the dam in accordance the arrangements to be agreed between the two Governments, Egyptian Ministry of Public Works and the Uganda Electricity Board will consult together on matters of mutual interest. Any differences of opinion which may arise, however, in connection with the control of water or with the generation of hydro-electric power will be a matter of discussion and settlement in a spirit of friendly co-operation between the m. If these authorities find themselves unable to settle it, the matter to be referred to arbitration in accordance with arrangements to be agreed between the two Governments."

I have the honour to propose that if the Royal Egyptian Government agrees, this Note and your Excellency's reply should constitute a formal arrangement between our two Governments, regarding the dam at Owen Falls and the works connected therewith.

I have, &c.
Ronald Campbell

The amount of the contract is 3,639,540 5s. 0d.

As your Excellency is also aware, the Uganda Electricity Board has further awarded a contract for ironwork to Messrs. Glenfield and Kennedy, to the amount of 124,866.

On instructions from His Majesty's Principle Secretary of Sate for Foreign Affairs, I now have the honour to inform your Excellency that His Majesty's Government in the United Kingdom approve these contracts. If the Royal Egyptian Government also approve them, your Excellency's reply in that and this Note will constitute the exchange of formal Notes referred to in paragraph 2 above. I should be happy to arrange for the Government of Uganda to be notified accordingly.

I have, &c.
Ronald Campbell

II

The Egyptian Minister for Foreign Affairs ad interim to His Majesty's Ambassador at Cairo

[TRANSLATION[3] -- TRADUCTION[4]]

MINISTRY OF FOREIGN AFFAIRS

Cairo, 5th December

Your Excellency,

I have the honour to acknowledge receipt of your Excellency's Note the 5th of December, in which you inform me that His Majesty's Government has approved the award of two contracts, viz:

(1) The first concerns the building of the dam and the hydro-electric power station at the Owen Falls which the Uganda Electricity Board has awarded to the group led by Christiani & Nielsen, Limited, to the amount of 3,639,540 5s. 0d. This group comprises:

Dorman, Long and Company, Limited;
Edmund Nuttall, Sons & Company (London), Limited;
Hollandsche Beton Maatschappij, N/V;
Internationale Gewapendbeton Bouw, N/V;
K. L. Kier & Company (London), Limited;
Nederlandsche Aanneming Maatschappij, N/V, late firm N. F. Boersman
Nederlandsche Beton Maatschappij, "Bato," N/V.

[1]Came into force on 31 May 1949 by the exchange of the said notes.
[2]Exchange of notes in regard to the use of the waters of the River Nile for irrigation of Cairo, 7 May 1929. League of Nations, Treaty Series, Vol. XCIII, p. 43. See also United Treaty Series, Vol. 207, p. 277.
[3]Translation by the Government of the United Kingdom.
[4]Traduction du Gouvernement du Royaume-Uni.

Title: Exchange of notes constituting an agreement between the Government of the United Kingdom of Great Britain and Northern Ireland (on behalf of Uganda) and the Government of Egypt regarding cooperation in meteorological, and Hydrological surveys in certain areas of the Nile Basin
Parties: Egypt, Great Britain (Uganda)
Basin: Nile
Date: 1/19/1950

No. 3123. EXCHANGE OF NOTES CONSTITUTING AN AGREEMENT[1] BETWEEN THE GOVERNMENT OF THE UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND (ON BEHALF OF THE GOVERNMENT OF UGANDA) AND THE GOVERNMENT OF EGYPT REGARDING CO-OPERATION IN METEOROLOGICAL, AND HYDROLOGICAL SURVEYS IN CERTAIN AREAS OF THE NILE BASIN. CAIRO, 19 JANUARY, 28 FEBRUARY AND 20 MARCH 1950

1

The Egyptian Minister for Foreign Affairs to His Majesty's Ambassador at Cairo

[Translation[2]]

MINISTRY OF FOREIGN AFFAIRS

Cairo, 19th January, 1950

Your Excellency,

I have the honour to inform your Excellency that during last November official discussions took place in Uganda between the representatives of the Egyptian Ministry of Public Works and the appropriate departments of the Uganda Government with a view to organising the recording of meteorological and hydrological information about the Equatorial Lakes.

In view of the importance and the ever-growing need for Egypt to collect all possible data about the Lakes the Ministry of Public Works intends to take urgent measures to draw up a plan for research, observation, and meteorological and hydrological recording on a much more comprehensive scale than has been undertaken so far.

As a result of these discussions the Government of Uganda, which has already set up a special Department to collect and record hydrological data in Uganda, intends to extend this work and to include both the collection of hydrological data from all the areas of the basin which feeds the Nile, whether in the East African territories or in the Belgian Congo and which are marked on the attached map[3] and the gathering of certain additional data concerning Lake Victoria which are not at present collected by any other organisation.

In addition, the Royal Egyptian Government will be pleased to co-operate in this field with the Government of Uganda in accordance with the following conditions :-

1.-The Egyptian Government agree that the Government of Uganda should take on the services of M. Winny as well as make use of the equipment at present in Uganda.

2.-All the meteorological and hydrological data and information collected by the Hydrological Department of Uganda for the observation posts marked on the attached map will be supplied to the Egyptian Government.

Moreover, these posts may be changed and their number increased or reduced from time to time after consultation with the Ministry of Public Works.

3.-The Resident Egyptian Engineer at the Owen Falls Dam and his assistants who will be established at Jinja, shall have access to all the Posts which are in Uganda in order to undertake periodical inspections to assure themselves that the posts are being satisfactorily maintained and the observations regularly collected.

4.-The Royal Egyptian Government agree to contribute to the expenses incurred in obtaining and calculating the meteorological and hydrological data and information mentioned above an annual sum of £E.4,200 which, if the circumstances warrant it, shall be subject to a revision to be muturally agreed and may be increased to a maximum figure of £E.4,500.

5.-In due course an evaluating station will be established similar to the existing by the Delta Barrage. Until this can be done, the measurements of the current will continue to be sent to Egypt, preferably by air courier, for purposes of evaluation.

6.-The 1st of March, 1950, is proposed as a suitable date for the entry into force of the new arrangement.

7.-The official Exchange of Notes to this effect shall constitute an Agreement between the two Governments.

I should be very much obliged if your Excellency would transmit the forgoing to the Government of Uganda.

Please accept, &c.
M. SALAH EL DIN

II

His Majesty's Ambassador at Cairo to the Egyptian Minister for Foreign Affairs

BRITISH EMBASSY

Cairo, 28th February, 1950

Monsieur le Ministre,

I have the honour to refer to your Excellency's Note of 19th January in you requested me to advise the Government of Uganda that the Royal Egyptian Government would be prepared to co-operate with that Government in meteorological and hydrological surveys in certain specified areas of the Nile Basin on the following conditions :-

[See note I]

At the request of the request of the Governor of Uganda, and on instructions from His Majesty's Principal Secretary of State for Foreign Affairs, I now have the honour to inform your Excellency that the Government of Uganda agree to co-operate in this matter with the Royal Egyptian Government on the conditions as set out above. If the Royal Egyptian Government confirm that they are also in agreement, your Excellency's reply in that sense and this Note will constitute the exchange of formal notes referred to in sub-paragraph 7 of your Excellency's Note under reference.

I have, &c.
Ronald Campbell

III

The Egyptian Minister for Foreign Affairs to His Majesty's Ambassador at Cairo

[Translation[4]]
MINISTRY OF FOREIGN AFFAIRS

Cairo, March 20, 1950

Your Excellency,

I have the honour to acknowledge receipt of your Excellency's Note of the 28th of February, 1950, in which you were kind enough to convey to me the agreement of the Government of Uganda to co-operate with the Royal Egyptian Government for the purpose of organising the collation of meteorological and hydrological data concerning the Equatorial Lakes in accordance with the conditions described in our Note of January 19, 1950.

In reply, I have the honour to inform your Excellency that the Royal Egyptian Government agree that the Exchange of the two Notes, that under reference and the present one, constitute a formal agreement to this effect between the Royal Egyptian Government and the Government of Uganda.

Please accept, &c.
M. SALAH EL DIN

[1] Came into force on 20 March 1950, with effect from 1 March 1950, in accordance with terms of the said notes.
[2] Translation by the Government of the United Kingdom.
[3] Not reproduced by the Government of the United Kingdom.
[4] Translation by the Government of the United Kingdom.

AGREEMENT

BETWEEN

THE UNITED ARAB REPUBLIC

AND

THE REPUBLIC OF SUDAN

FOR

THE FULL UTILIZATION OF THE NILE WATERS,

SIGNED AT

CAIRO, NOVEMBER 8, 1959

Sudan - United Arab Republic

AGREEMENT BETWEEN THE UNITED ARAB REPUBLIC AND THE REPUBLIC OF SUDAN FOR THE FULL UTILIZATION OF THE NILE WATERS, SIGNED AT CAIRO, NOVEMBER 8, 1959 AND PROTOCOL CONCERNING THE ESTABLISHMENT OF PERMANENT JOINT TECHNICAL COMMITTEE SIGNED AT CAIRO, JANUARY 17, 1960.

Whereas the full utilization of the Nile waters for the benefit of the United Arab Republic and the Republic of Sudan requires the implementation of projects for the full control of the river and the increase of its water supply and the planning of new Working Arrangements on lines different from those followed under present conditions;

Whereas for the establishment and working of such projects complete agreement and full co-operation between the two Republics is necessary in order to make the best use of the available water in such manner as to guarantee both their present and future requirements;

Whereas the Nile Waters Agreement concluded in 1929 has only regulated a partial use of the natural river and did not cover the future conditions of a fully controlled river supply, the two Republics have agreed to the following:

I.-*The present established rights*

1. The quantities of water actually used by the United Arab Republic until the date of signing this Agreement constitute their established right prior to the benefit accruing them through the implementation of the control works referred to in this agreement. This established right amounts to 48 milliards of cubic meters per year measured at Aswan.

2. The quantities of water used at present by the Republic of the Sudan constitute their established right prior to the benefits accruing to them through the implementation of the afore mentioned control works. This established right amounts to 4 milliards cubic meters per year as at Aswan.

II.-*Nile control works and the sharing of their benefit between the Republics*

1. In order to make use of the full natural river supply and stop the flow of any excess of the sea, the two Republics agree to the construction by the U.A.R. of the Sudd el Aali Reservoir at Aswan as the first of a series of over-year storage schemes on the Nile.

2. In order to enable the Republic of Sudan to exploit their share, the two Republics agree to the construction by the Sudan Republic of the Roseires Reservoir on the Blue Nile and any other works deemed necessary by the Sudan for the same purpose.

3. The net benefit from the Sudd el Aali Reservoir shall be calculated on the basis of the mean natural river supply at Aswan in the past years of this century and which amounts to 84 milliards of cubic meters per year. The established rights of the two Republics referred to in

Article I, as well as the mean value of the over-years storage yearly losses in the Sudd el Aali Reservoir, shall be deducted from the above mentioned mean natural river, in order to obtain the net yearly benefit to be shared by the two Republics.

4. The net benefit from the Sudd el Aali Reservoir referred to in the previous paragraph, shall be allotted between the two Republics at the ratio of 14.5 for Sudan to 7.5 for the United Arab Republic as long as the mean natural river supply remains within the limiting value mentioned in the previous paragraph. This means that as long as the computed mean natural river supply is equal to 84 milliards of cubic meters per year, and the mean value of the over-year storage losses remain equal to its present estimated value of 10 milliards of cubic meters per year, then the net benefit from the Sudd el Aali reservoir is 22 milliards of cubic meters of which 14.5 milliards shall be allotted to the Republic of Sudan and 7.5 milliards to the United Arab Republic. By adding these benefits to the respective established rights, the total shares in the net mean natural supply after the working of the complete Sudd el Aali Reservoir, shall be 18.5 milliards per year for the Republic of Sudan, and 55.5 milliards per year for the United Arab Republic.

If the mean natural river exceeds 84 milliards per year, then the resulting increase in the net benefit due to the increase in the mean natural river shall be equally divided between the two Republics.

5. As the net benefit from the Sudd el Aali Reservoir, referred to in paragraph (3) article II, is calculated by deducting the established rights and the mean over-year storage yearly losses, from the mean natural river supply of the past years to the present century, it is recognized that this net benefit shall be subject to revision by both parties at reasonable intervals to be agreed upon as from the date of the operation of the complete Sudd el Aali Reservoir.

6. The Government of the United Arab Republic agree to the payment of fifteen million Egyptian pounds to the Government of the Republic of Sudan as full compensation for the damages to present Sudanese property, resulting from the storage of water in the Sudd el Aali Reservoir to a level of 182.00 meters (Survey). Such payment shall be affected as agreed upon by both parties in the Annex attached thereto.

7. The Government of the Republic of Sudan undertake to take steps to transfer the population round Halfa as well as all other Sudanese inhabitants - whose properties will be affected by the maximum storage in the Sudd el Aali Reservoir - prior to July 1963.

8. It is recognized that after the working of the complete Sudd el Aali Reservoir for over-year storage, the United Arab Republic will not require the use of Gebel Aulia Reservoir for storage. The two contracting parties shall examine all matters related to such renunciation in due time.

III. -*Projects for the exploitation of waters lost in the Upper Nile Basin*

In view of the fact that quantities of the Nile Basin waters are wasted in the swamps of Bahr el Zeraf, Bahr el Ghazal, River Sobat, and the conservation of these waters for increasing the

present natural river supply is most vital for the future agricultural developments, the United Arab Republic and the Republic of Sudan agree to the following:

1. In agreement with the United Arab Republic, the Republic of Sudan shall carry out projects for increasing the River Nile water supply by the prevention of excess losses in the swamps of Bahr el Gebel, Bahr el Zeraf, Bahr el Gahzal and its branches, River Sobat and its branches and the White Nile.

The water benefit from such projects as well as the total costs of construction shall be shared equally by the two Republics.

The Republic of the Sudan shall defray the costs of the above mentioned projects and shall be reimbursed by the United Arab Republic on the basis of half the profits designated in these projects.

2. In case the United Arab republic need more water to cope with their progress in the agricultural expansion program, and therefore find it necessary to take the necessary steps to carry out one of the above mentioned schemes at a time when the need of the republic of Sudan might not have arisen, the United Arab Republic will notify the Republic of Sudan of the date on which the former intend to start the execution and in the course of two years from the date of such notification, each of the two Republics shall submit their program of expansion and the dates and quantities of their water requirements from the benefit of the scheme. Any such program shall be binding to both parties. At the expiration of the two years, the United Arab Republic shall start the execution of the project at its own expense. When the Republic of the Sudan is ready to make use of its share according to the agreed program, they shall then reimburse to the United Arab Republic their share in the cost, in the same proportion to the total cost as their share in the benefit is to the total actual benefit of the scheme. The final share of either party shall not exceed 50% of the total benefit.

IV. -*Technical Co-operation between the two Republics*

1. To insure technical co-operation between the two Republics to carry out the necessary study and research in connection with projects for the Nile Control and the increase of its supply and for the continuation of Hydrological survey work of the River in its upper reaches, the two Republics agree to constitute a Permanent Joint Technical Committee composed of an equal number of members from both Republics. This committee shall be formed after signing this agreement and shall have the following terms of reference:

(a) To draw the main lines of schemes aiming at the increase of the River supply and to supervise and direct the research work and investigations and collection of data necessary for the preparation of projects reports to be submitted to both Government for approval.

(b) To supervise the execution of the approved projects.

(c) To draw up the working arrangements for works implemented in territories outside the Sudan by agreement with their concerned authorities.

(d) To supervise the application of all aforesaid working arrangements in article *(c)* by means of engineers appointed for this purpose and selected from officials from the two Republics in connection with works in the Sudan and also the Sudd el Aali and Aswan Reservoir and according to agreements with other governments, in connection with works outside the Sudan.

(e) In view of the possibility of the occurrence of a series of years of low river supply causing a continuous drop in the Sudd el Aali Reservoir levels to the stage that will not enable

both Republics to draw their normal quota in any year, the Committee shall put up the necessary arrangements to be followed by both parties to face the shortage of supply in such low years in a manner that will not cause any damage to either party and shall submit their proposals for approval by both Republics.

2. To enable the Committee to carry out duties referred to in paragraph 1 above, and to insure the continuation of the observation of gauges and discharges of the River in all it upper reaches, these duties shall be carried out under the supervision of the Committee within the technical field by the engineers of the Republic of Sudan and the staff of the United Arab Republic in the Sudan, and in Uganda.

3. The two Republics shall issue a joint order covering the formation of the Permanent Joint Technical Committee, the names of its members, and the necessary budget to be provided from the funds of both Republics.

The Committee shall meet either in Cairo or in Khartoum according to circumstances and shall establish its own rules of procedure subject to the approval of the two Governments and which shall include the necessary regulations in connection with meetings, technical, administrative and financial activities.

V.-*General Provisions*

1. In case any question connected with Nile water needs negotiations with the governments of any riparian territories outside the Republic of Sudan and the United Arab Republic, the two Republics shall agree beforehand on a unified view in accordance with the investigations of the problem by the Committee. This unified view shall then form the basis of instructions to be followed by the Committee in the negotiations with the governments concerned.

Should such negotiations result in an agreement to construct works on the Nile in territories outside the two Republics, the Permanent Joint Committee shall then assume the responsibility to contact the concerned authorities in those territories, in order to lay down all the technical details in connection with the execution as well as the Working Arrangements and maintenance of the works in question. After agreement on these points with the governments concerned, the Committee shall supervise the execution of the technical provisions of such agreements.

2. Since other riparian countries on the Nile besides the Republic of Sudan and the United Arab Republic claim a share in the Nile waters, both Republics agree to study together these claims and adopt a unified view thereon. If such studies result in the possibility of allotting an amount of the Nile water to one or the other of these territories, then the value of this amount as at Aswan shall be deducted in equal shares from the share of each of the two Republics.

The Permanent Joint Technical Committee shall make arrangements with the concerned authorities in other territories in connection with the control and checking of the agreed amounts of Nile water consumption.

VI.-*Transition period before the working of the complete Sudd el Aali*

Whereas both Republics shall benefit from their respective shares in the net benefit of the Sudd el Aali Reservoir only when the latter shall be complete and shall yield its benefit, both

parties shall agree on their interim program of expansion in the transition period - from now until the working of the complete Sudd el Aali - in a manner that shall not affect their present water requirements.

VIII.- Annexure 1 as well as Annexures 2 (A) and 2(B) attached hereto shall be considered as an integral part of this agreement.

ANNEXURE I

Text Concerning the water loan requested by the United Arab Republic

The Republic of Sudan agree in principle to grant the United Arab Republic a water loan from the Sudanese share in the Sudd el Aali benefit in order to enable the latter Republic to meet the requirements of the agricultural expansion program.

The United Arab Republic shall request such loan after the revision of the expansion program in the course of five years from the date of signing this Agreement. If such a revision shows that the United Arab Republic still need the loan, the Republic of Sudan shall grant the United Arab Republic a loan not exceeding one and a half milliards of cubic meters from their share provided that the use of such share shall cease in November 1977.

ANNEXURE II (A)

To the Chairman
Of the Delegation of the
Republic of Sudan

With reference to Article II, paragraph 6, of the Agreement signed on today's date, concerning the full utilization of the River Nile waters, compensation amounting to £E. 15 millions, shall be paid in pounds sterling or in a third currency to be agreed upon by both parties, calculated at a constant rate of $2.87156 to each Egyptian pound.

As agreed, the Government of the United Arab Republic shall pay this amount in the following installments:

£Eg. 3millions on 1st January 1960
" 4 " " " " 1961
" 4 " " " " 1962
" 4 " " " " 1963

I shall be very grateful if you would kindly confirm your agreement to the above arrangements.

ANNEXURE II (B)

To the Chairman
Of the United Arab Republic Delegation

I have the honor to acknowledge receipt of your letter of today's date reading as follows:

[See above]

I have the honor to confirm the Agreement of the Republic of Sudan to the contents of the said letter.

PROTOCOL CONCERNING THE ESTABLISHMENT OF THE PERMANENT TECHNICAL COMMITTEE

In confirmation of the complete and continuous cooperation aimed at by the Agreement for the Complete Utilization of the Nile Waters between the United Arab Republic and the Republic of the Sudan, signed on November 8, 1959;

and in implementation of Article 4 of said agreement which provides that a technical permanent committee be set up, composed of an equal number of members from each of the United Arab Republic of the Sudan;

the two Contracting Parties have agreed upon the following articles:

Article I. The Permanent Technical Committee shall be composed of the following:

(a) On the part of the United Arab Republic:

Chairman: Eng. Mohamed Khalil Ibrahim, Assistant Under-secretary of State, Ministry of Public Works;

Members: Eng. Abdel Azim Ismail, Technical Expert, Ministry of Public Works; Dr. Eng. Mohamed Amin, Technical Advisor, Ministry of Public Works; Eng. Tewfik Mohamed Khalifa, Irrigation Inspector General at Khartoum;

(b) On the part of the Republic of the Sudan:

Chairman: Mahmoud Mohamed Gadeen, Director, Ministry of Irrigation;

Deputy Chairman: Mohamed el-Rasheed Sayed Ahmed, Deputy Advisor for Irrigation;

Members: Zaghiroon el-Zein, Deputy Director for Irrigation; Yeida Abdel Meguid, Engineer-in-Chief, Water Research.

Article II. If, in future, circumstances should require the bringing about of any alteration to the Joint Committee's composition, such an alteration shall be effected pursuant to letters exchanged between the Ministers of Foreign Affairs of the United Arab Republic and the Republic of the Sudan upon the proposal of the appropriate authorities of both countries.

Article III. The present protocol shall be considered supplementing the Agreement for the Complete Utilization of the Nile Waters signed on November 8, 1959, and shall have effect as of the date of its signing.

FRAMEWORK

FOR GENERAL COOPERATION

BETWEEN

THE ARAB REPUBLIC OF EGYPT

AND

ETHIOPIA

SIGNED AT

CAIRO, JULY 1, 1993

FRAMEWORK FOR GENERAL CO-OPERATION BETWEEN THE ARAB REPUBLIC OF EGYPT AND ETHIOPIA

THE ARAB REPUBLIC OF EGYPT AND ETHIOPIA,

DETERMINED TO CONSOLIDATE THE TIES OF FRIENDSHIP, TO ENHANCE COOPERATION BETWEEN THE TWO COUNTRIES AND TO ESTABLISH A BROAD BASE OF COMMON INTERESTS,

DESIROUS OF THE REALIZATION OF THEIR FULL ECONOMIC AND RESOURCE POTENTIALS,

RECOGNIZING THE IMPORTANCE OF THE TRADITIONAL TIES EXISTING BETWEEN THE TWO COUNTRIES THAT HAVE BEEN CONSOLIDATED DURING THEIR LONG HISTORY OF CLOSE RELATIONS AND LINKED BY THE NILE RIVER WITH ITS BASIN AS A CENTER OF MUTUAL INTEREST,

REAFFIRMING THEIR COMMITMENT TO THE UN AND OAU CHARTERS, PRINCIPLES OF INTERNATIONAL LAW, AS WELL AS THE LAGOS PLAN OF ACTION,

HEREBY AGREE ON THE FOLLOWING FRAMEWORK FOR COOPERATION:

ARTICLE 1

THE TWO PARTIES REAFFIRM THEIR COMMITMENT TO THE PRINCIPLES OF GOOD NEIGHBOURLINESS, PEACEFUL SETTLEMENT OF DISPUTES, AND NON-INTERFERENCE IN THE INTERNAL AFFAIRS OF STATES.

ARTICLE 2

THE TWO PARTIES ARE COMMITTED TO THE CONSOLIDATION OF MUTUAL TRUST AND UNDERSTANDING BETWEEN THE TWO COUNTRIES.

ARTICLE 3

THE TWO PARTIES RECOGNIZE THE IMPORTANCE OF THEIR COOPERATION AS AN ESSENTIAL MEANS TO PROMOTE THEIR ECONOMIC AND POLITICAL INTERESTS AS WELL AS STABILITY OF THE REGION.

ARTICLE 4

THE TWO PARTIES AGREE THAT THE ISSUE OF THE USE OF THE NILE WATERS SHALL BE WORKED OUT IN DETAIL THROUGH DISCUSSIONS BY EXPERTS FROM BOTH SIDES, ON THE BASIS OF THE RULES AND PRINCIPLES OF INTERNATIONAL LAW.

ARTICLE 5

EACH PARTY SHALL REFRAIN FROM ENGAGING IN ANY ACTIVITY RELATED TO THE NILE WATERS THAT MAY CAUSE APPRECIABLE HARM TO THE INTERESTS OF THE OTHER PARTY.

ARTICLE 6

THE TWO PARTIES AGREE ON THE NECESSITY OF THE CONSERVATION AND PROTECTION OF THE NILE WATERS. IN THIS REGARD, THEY UNDERTAKE TO CONSULT AND COOPERATE IN PROJECTS THAT ARE MUTUALLY ADVANTAGEOUS, SUCH AS PROJECTS THAT WOULD ENHANCE THE VOLUME OF FLOW AND REDUCE THE LOSS OF NILE WATERS THROUGH COMPREHENSIVE AND INTEGRATED DEVELOPMENT SCHEMES.

ARTICLE 7

THE TWO PARTIES WILL CREATE APPROPRIATE MECHANISM FOR PERIODIC CONSULTATIONS ON MATTERS OF MUTUAL CONCERN, INCLUDING THE NILE WATERS, IN A MANNER THAT WOULD ENABLE THEM TO WORK TOGETHER FOR PEACE AND STABILITY IN THE REGION.

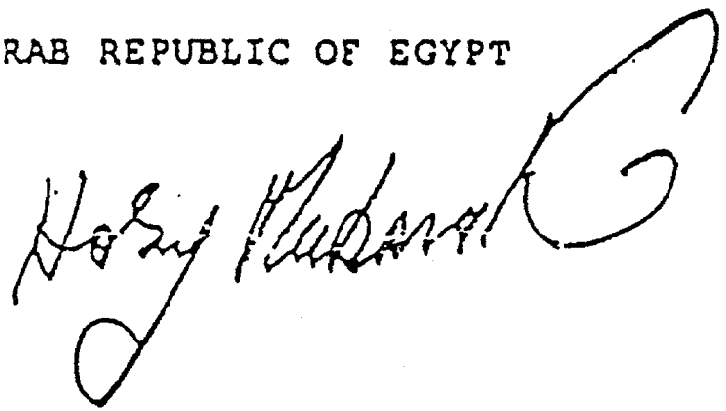
ARTICLE 8

THE TWO PARTIES SHALL ENDEAVOUR TOWARDS A FRAMEWORK FOR EFFECTIVE COOPERATION AMONG COUNTRIES OF THE NILE BASIN FOR THE PROMOTION OF COMMON INTEREST IN THE DEVELOPMENT OF THE BASIN.

THIS FRAMEWORK FOR COOPERATION IS MADE IN TWO ORIGINALS IN THE ARABIC AND ENGLISH LANGUAGES, BOTH TEXTS BEING EQUALLY AUTHENTIC.

DONE AT CAIRO THIS 1st DAY OF THE MONTH OF JULY 1993.

FOR THE
ARAB REPUBLIC OF EGYPT



HOSNI HOUBARAK
PRESIDENT OF THE
REPUBLIC

FOR
ETHIOPIA

HELES ZENAWI
PRESIDENT OF THE
TRANSITIONAL GOVERNMENT

AGREEMENT

ON

THE NILE RIVER BASIN COOPERATIVE FRAMEWORK

FRAMEWORK

DRAFT OPENED FOR SIGNATURE AT

ENTEBBE, MAY 14, 2010

Agreement
On the
Nile River Basin Cooperative Framework

Accord-cadre
Sur la
Coopération dans le Bassin du Fleuve Nil

Accord-cadre sur la coopération dans le Bassin du Fleuve Nil	**Agreement on the Nile River Basin Cooperative Framework**
Préambule	**Preamble**
Les Etats du Bassin du Fleuve Nil,	The States of the Nile River Basin,
Affirmant l'importance du Nil pour le bien-être économique et social des peuples des Etats du Bassin du Fleuve Nil,	*Affirming* the importance of the Nile River to the economic and social well-being of the peoples of the States of the Nile River Basin,
Soucieux de renforcer leur coopération ayant trait au Fleuve Nil dans la gestion du Nil, ressource naturelle essentielle et vitale, et ce pour le développement durable du Bassin du Fleuve Nil,	*Motivated* by the desire to strengthen their cooperation in relation to the Nile River, a great and vital natural resource which binds them together, and in relation to the sustainable development of the Nile River Basin,
Reconnaissant que le Fleuve Nil, ses ressources naturelles et son environnement sont des biens d'une valeur immense pour tous les pays riverains,	*Recognizing* that the Nile River, its natural resources and environment are assets of immense value to all the riparian countries,
Convaincus qu'un accord-cadre régissant leurs relations en ce qui concerne le Bassin du Fleuve Nil favorisera une gestion intégrée, un développement durable et une utilisation harmonieuse des ressources en eau du Bassin, ainsi que leur conservation et leur protection au profit des générations présentes et futures,	*Convinced* that a framework agreement governing their relations with regard to the Nile River Basin will promote integrated management, sustainable development, and harmonious utilization of the water resources of the Basin, as well as their conservation and protection for the benefit of present and future generations,
Convaincus également qu'il est de leur intérêt commun d'établir une organisation pour les assister dans la gestion et le développement durable du Bassin du Fleuve Nil au profit de tous,	*Convinced also* that it is in their mutual interest to establish an organization to assist them in the management and sustainable development of the Nile River Basin for the benefit of all,
Conscients des initiatives mondiales pour la promotion de la coopération en matière de gestion intégrée et de développement durable des ressources d'eau,	*Mindful* of the global initiatives for promoting cooperation on integrated management and sustainable development of water resources,
Sont convenues de ce qui suit:	*Have agreed as follows*:

Article 1 **Champ d'application du présent Accord** Le présent Accord s'applique à l'utilisation, au développement, à la protection, à la conservation et à la gestion du Bassin du Fleuve Nil ainsi que de ses ressources et établit un mécanisme institutionnel pour la coopération des Etats du Bassin du Fleuve Nil. **Article 2** **Définitions** Aux fins du présent Accord sur le Cadre de Coopération : (a) « le Bassin du Fleuve Nil » s'entend du secteur géographique déterminé par les lignes de partage du système des eaux du Fleuve Nil; ce terme est utilisé où est fait référence à la protection, à la conservation et au développement de l'environnement. (b) « le système du Fleuve Nil » s'entend du Nil, des eaux de surface et des eaux souterraines qui lui sont liées; ce terme est utilisé où est fait référence à l'utilisation de l'eau. (c) « Cadre » s'entend du présent Accord-cadre sur la Coopération. (d) « Etat du Bassin du Fleuve Nil », « Etat du Bassin du Fleuve Nil » ou « Etat du Bassin » s'entend d'un Etat partie au présent Accord sur le territoire duquel est située une portion du Bassin du Fleuve Nil;	**Article 1** **Scope of the Present Framework** The present Framework applies to the use, development, protection, conservation and management of the Nile River Basin and its resources and establishes an institutional mechanism for cooperation among the Nile Basin States. **Article 2** **Use of Terms** For the purposes of the present Cooperative Framework Agreement: (a) "Nile River Basin" means the geographical area determined by the watershed limits of the Nile River system of waters; this term is used where there is reference to environmental protection, conservation or development; (b) "Nile River system" means the Nile River and the surface waters and groundwaters which are related to the Nile River; this term is used where there is reference to utilization of water; (c) "Framework" means the present Cooperative Framework Agreement; (d) "State of the Nile River Basin", "Nile Basin State" or "Basin state" means a State party to the present Framework in whose territory part of the Nile River Basin is situated;

(e) « La Commission » désigne la Commission du Bassin du Fleuve Nil créée par les dispositions de la partie III du présent Accord.	(e) "The Commission" means the Nile River Basin Commission established under Part III of the present Framework;
(f) « Sécurité de l'eau » désigne le droit qu'ont tous les Etats du Bassin du Fleuve Nil à l'accès et à l'utilisation fiables du système du Fleuve Nil pour la santé, l'agriculture, les moyens d'existence, la production et l'environnement.	(f) "Water security" means the right of all Nile Basin States to reliable access to and use of the Nile River system for health, agriculture, livelihoods, production and environment.

PARTIE I. PRINCIPES GÉNÉRAUX

Article 3
Principes Généraux

Le système du Fleuve Nil doit être protégé, utilisé, conservé et développé selon les principes généraux suivants.

1. **Coopération**

   Le principe de coopération entre les Etats du Bassin du Fleuve Nil sur la base de l'égalité souveraine, de l'intégrité territoriale, du bénéfice mutuel et de la bonne foi, afin d'atteindre une utilisation optimale, une protection adéquate et la conservation du Bassin du Fleuve Nil et de promouvoir des efforts communs afin de réaliser le développement économique et social des Etats du Bassin du Fleuve Nil.

2. **Développement durable**

   Le principe du développement durable du Bassin du Fleuve Nil.

3. **Subsidiarité**

   Le principe de subsidiarité, en vertu duquel le développement et la protection des ressources en eau du Bassin du Fleuve Nil sont planifiés et mis en œuvre à l'échelon le plus bas possible.

4. **Utilisation équitable et raisonnable**

   Le principe de l'utilisation équitable et raisonnable des eaux du système du fleuve Nil.

PART I. GENERAL PRINCIPLES

Article 3
General Principles

The Nile River System and its waters shall be protected, used, conserved and developed in accordance with the following general principles.

1. **Cooperation**

   The principle of cooperation between States of the Nile River Basin on the basis of sovereign equality, territorial integrity, mutual benefit and good faith in order to attain optimal utilization and adequate protection and conservation of the Nile River Basin and to promote joint efforts to achieve social and economic development.

2. **Sustainable development**

   The principle of sustainable development of the Nile River Basin.

3. **Subsidiarity**

   The principle of subsidiarity, whereby development and protection of the Nile River Basin water resources is planned and implemented at the lowest appropriate level.

4. **Equitable and reasonable utilization**

   The principle of equitable and reasonable utilization of the waters of the Nile River System.

5. Prévention de la survenance de dommages significatifs Le principe de prévention de la survenance de tout dommage significatif au préjudice des autres Etats du Bassin du Fleuve Nil. **6. Le Droit des Etats du Bassin du Fleuve Nil d'utiliser l'eau sur leur territoire** Le principe selon lequel chaque Etat du Bassin du Fleuve Nil a le droit d'utiliser, sur son territoire, les eaux du Bassin du Fleuve Nil d'une manière compatible avec les principes de base énoncés par le présent accord. **7. Protection et conservation** Le principe selon lequel les Etats du Bassin du Fleuve Nil prennent toutes les mesures appropriées, individuellement et, le cas échéant, conjointement, pour la protection et la conservation du Bassin du Fleuve Nil et de ses écosystèmes. **8. Informations relatives aux mesures planifiées** Le principe selon lequel tous les Etats du Bassin du Fleuve Nil échangent de l'information sur les mesures planifiées par l'intermédiaire de la Commission du Bassin du Fleuve Nil. **9. Communauté d'intérêt** Le principe de la communauté d'intérêt des Etats du Bassin du Fleuve Nil dans le système du fleuve Nil. **10. Échange de données et d'informations** Le principe de l'échange régulier et réciproque entre les Etats du Bassin du Fleuve Nil de toute donnée et information aisément accessible et pertinente sur des mesures existantes et sur la situation des ressources en eau du Bassin, si possible sous une forme qui facilite son utilisation par les Etats auxquels elle est destinée.	**5. Prevention of the causing of significant harm** The principle of preventing the causing of significant harm to other States of the Nile River Basin. **6. The right of Nile Basin States to use water within their territories** The principle that each Nile Basin State has the right to use, within its territory, the waters of the Nile River System in a manner that is consistent with the other basic principles referred to herein. **7. Protection and conservation** The principle that Nile Basin States take all appropriate measures, individually and, where appropriate, jointly, for the protection and conservation of the Nile River Basin and its ecosystems. **8. Information concerning planned measures** The principle that the Nile Basin States exchange information on planned measures through the Nile River Basin Commission. **9. Community of interest** The principle of the community of interest of the Nile Basin States in the Nile River System. **10. Exchange of data and information** The principle of the regular and reciprocal exchange among States of the Nile River Basin of readily available and relevant data and information on existing measures and on the condition of water resources of the Basin, where possible in a form that facilitates its utilization by the States to which it is communicated.

11. Evaluation d'impact environnemental et audits Le principe d'évaluation de l'impact sur l'environnement et des audits	**11. Environmental impact assessment and audits** The principle of environmental impact assessment and audits.
12. Règlement pacifique des différends Le principe du règlement pacifique des différends.	**12. Peaceful resolution of disputes** The principle of the peaceful resolution of disputes.
13. L'eau comme ressource limitée et vulnérable Le principe selon lequel l'eau douce est une ressource limitée et vulnérable, essentielle pour maintenir la vie, le développement et l'environnement ; qu'elle doit être gérée d'une manière intégrée et holistique, liant le développement économique et social à la protection et à la conservation des écosystèmes naturels.	**13. Water as a finite and vulnerable resource** The principle that fresh water is a finite and vulnerable resource, essential to sustain life, development and the environment, and must be managed in an integrated and holistic manner, linking social and economic development with protection and conservation of natural ecosystems.
14. L'eau a une valeur économique et sociale Le principe selon lequel l'eau est une ressource naturelle ayant une valeur sociale et économique, qui doit être utilisée en priorité de la manière la plus économique, en tenant compte de la satisfaction des besoins de base de la population et de la sauvegarde des écosystèmes.	**14. Water has social and economic value** The principle that water is a natural resource having social and economic value, whose utilization should give priority to its most economic use, taking into account the satisfaction of basic human needs and the safeguarding of ecosystems.
15. Sécurité de l'eau Le principe de sécurité de l'eau pour tous les Etats du Bassin du Fleuve Nil.	**15. Water security** The principle of water security for all Nile Basin States.

PARTIE II. DROITS ET OBLIGATIONS

Article 4

Utilisation équitable et raisonnable

1. Les Etats du Bassin du Fleuve Nil utilisent les ressources en eau du système du Fleuve Nil et du Bassin du Fleuve Nil d'une manière équitable et raisonnable sur leurs territoires respectifs. En particulier, ces ressources en eau sont utilisées et développées par les Etats du Bassin du Fleuve Nil de manière à parvenir à une utilisation optimale et durable de ces eaux et à en retirer tous les bénéfices, tout en tenant compte des intérêts des Etats du Bassin concernés et en garantissant une protection adéquate de ces ressources en eau. Chaque Etat du Bassin a droit à une part équitable et raisonnable des utilisations utiles des ressources en eau du système du Fleuve Nil et du Bassin du Fleuve Nil.

2. Pour s'assurer du caractère équitable et raisonnable de leur utilisation des ressources en eau du système du Fleuve Nil, les Etats du Bassin du Fleuve Nil tiennent compte de tous les facteurs et circonstances pertinents, notamment :

   a. des facteurs d'ordre géographique, hydrographique, hydrologique, climatique, écologique et autres facteurs de caractère naturel ;

   b. des besoins sociaux et économiques des Etats du Bassin concernés ;

   c. de la population dépendante des ressources en eau dans chaque Etat du Bassin ;

   d. des effets de l'utilisation ou des utilisations des ressources en eau dans un Etat, dans les autres Etats du Bassin ;

   e. des utilisations éventuelles et existantes des ressources en eau ;

PART II. RIGHTS AND OBLIGATIONS

Article 4

Equitable and reasonable utilization

1. Nile Basin States shall in their respective territories utilize the water resources of the Nile River system and the Nile River Basin in an equitable and reasonable manner. In particular, those water resources shall be used and developed by Nile Basin States with a view to attaining optimal and sustainable utilization thereof and benefits therefrom, taking into account the interests of the Basin States concerned, consistent with adequate protection of those water resources. Each Basin State is entitled to an equitable and reasonable share in the beneficial uses of the water resources of the Nile River system and the Nile River Basin.

2. In ensuring that their utilization of Nile River system water resources is equitable and reasonable, Nile Basin States shall take into account all relevant factors and circumstances, including but not limited to the following:

   a. Geographic, hydrographic, hydrological, climatic, ecological and other factors of a natural character.

   b. The social and economic needs of the Basin States concerned;

   c. The population dependent on the water resources in each Basin State;

   d. The effects of the use or uses of the water resources in one Basin State on other Basin States;

   e. Existing and potential uses of the water resources;

f. de la conservation, la protection, l'économie, et du développement de l'utilisation des ressources en eau et des coûts des mesures prises à cet effet ;	f. Conservation, protection, development and economy of use of the water resources and the costs of measures taken to that effect;
g. de l'existence d'alternatives, de valeur comparable à une utilisation particulière prévue ou existante ;	g. The availability of alternatives, of comparable value, to a particular planned or existing use;
h. de la contribution de chaque Etat du Bassin aux eaux du système du Fleuve Nil ;	h. The contribution of each Basin State to the waters of the Nile River system;
i. de l'ampleur et de la proportion du secteur de drainage sur le territoire de chaque Etat du Bassin.	i. The extent and proportion of the drainage area in the territory of each Basin State.
3. Pour l'application des paragraphes 1 et 2 ci-dessus, les Etats du Bassin du Fleuve Nil concernés procéderont, en cas de besoin, à des consultations dans un esprit de coopération.	3. In the application of paragraphs 1 and 2 above, the Nile Basin States concerned shall, when the need arises, enter into consultations in a spirit of cooperation.
4. L'importance à donner à chaque facteur doit être déterminée en fonction de son importance par rapport à celle des autres facteurs pertinents. Pour définir une utilisation raisonnable et équitable, tous les facteurs pertinents doivent être considérés conjointement et une conclusion doit être tirée sur la base de l'ensemble de ces facteurs.	4. The weight to be given to each factor is to be determined by its importance in comparison with that of other relevant factors. In determining what is a reasonable and equitable use, all relevant factors are to be considered together and a conclusion reached on the basis of the whole.
5. Les Etats du Bassin du Fleuve Nil doivent pour leurs territoires respectifs et conformément à leurs lois et règlements nationaux, évaluer le statut de leurs utilisations à la lumière de tout changement substantiel dans les circonstances et les facteurs pertinents.	5. Nile Basin States shall, in their respective territories, according to their national laws and regulations, keep the status of their water utilization under review in light of substantial changes in relevant factors and circumstances.
6. Les Etats du Bassin du Fleuve Nil se conforment aux règlements et aux procédures établis par la Commission du Bassin du Fleuve Nil pour la mise en œuvre d'une utilisation équitable et raisonnable.	6. Nile Basin States shall observe the rules and procedures established by the Nile River Basin Commission for the effective implementation of equitable and reasonable utilization.

Article 5 **Obligation de ne pas causer de dommages significatifs** 1. Lorsqu'ils utilisent les ressources en eau du système du Fleuve Nil sur leurs territoires, les Etats du Bassin du Fleuve Nil prennent toutes les mesures appropriées afin de ne pas causer de dommages significatifs à d'autres Etats du Bassin. 2. Néanmoins, lorsqu'un dommage significatif est causé à un autre Etat du Bassin du Fleuve Nil, l'Etat dont l'utilisation a causé ce dommage prennent, en l'absence d'accord concernant cette utilisation, toutes les mesures appropriées, dans le respect des dispositions de l'article 4 ci-dessus, en consultation avec l'Etat affecté, pour éliminer ou atténuer ce dommage et, le cas échéant, discuter de la question de l'indemnisation.	**ARTICLE 5** **Obligation not to cause significant harm** 1. Nile Basin States shall, in utilizing Nile River System water resources in their territories, take all appropriate measures to prevent the causing of significant harm to other Basin States. **2.** Where significant harm nevertheless is caused to another Nile Basin State, the States, whose use causes such harm shall, in the absence of agreement to such use, take all appropriate measures, having due regard to the provisions of Article 4 above, in consultation with the affected State, to eliminate or mitigate such harm and, where appropriate, to discuss the question of compensation.
Article 6 **Protection et conservation du Bassin du Fleuve Nil et de ses écosystèmes** 1. Les Etats du Bassin du Fleuve Nil prennent toutes les mesures appropriées, individuellement et, le cas échéant, conjointement, pour protéger, conserver et, en cas de besoin, réhabiliter le système le Bassin du Fleuve Nil et ses écosystèmes, à travers notamment : (a) la protection et l'amélioration de la qualité de l'eau dans le Bassin du Fleuve Nil ; (b) la prévention de l'introduction d'espèces étrangères ou nouvelles, dans le système du Fleuve Nil susceptibles d'avoir des effets dommageables sur les écosystèmes du système du Bassin du Fleuve Nil ;	**Article 6** **Protection and conservation of the Nile River Basin and its ecosystems** 1. Nile Basin States shall take all appropriate measures, individually and, where appropriate, jointly, to protect, conserve and, where necessary, rehabilitate the Nile River Basin and its ecosystems, in particular, by: (a) protecting and improving water quality within the Nile River Basin, (b) preventing the introduction of species, alien or new, into the Nile River system which may have effects detrimental to the ecosystems of the Nile River Basin;
(c) la protection et la conservation de la diversité biologique	(c) protecting and conserving biological diversity within

dans le Bassin du Fleuve Nil ; (d) la protection et la conservation des zones humides dans le Bassin du Fleuve Nil ; et (e) la reconstitution et la réhabilitation des ressources naturelles de base dégradées. 2. Les Etats du Bassin du Fleuve Nil procèdent, par le biais de la Commission du Bassin du Fleuve Nil, à l'harmonisation de leurs politiques relatives aux dispositions du présent article.	the Nile River Basin; (d) protecting and conserving wetlands within the Nile River Basin; and (e) restoring and rehabilitating the degraded natural resource base. 2. Nile Basin States shall, through the Nile River Basin Commission, take steps to harmonize their policies in relation to the provisions of this article.
ARTICLE 7 **Echange régulier de donnée et d'information** 1. Dans le cadre de leur coopération relative à l'utilisation, au développement et à la protection du Bassin du Fleuve Nil et de ses ressources en eau, les Etats du Bassin du Fleuve Nil échangent régulièrement des données et informations aisément accessibles et pertinentes sur des mesures existantes et sur la situation des ressources en eau du Bassin, si possible sous une forme qui facilite son utilisation par les Etats auxquels elle est destinée. 2. Si un Etat du Bassin du Fleuve Nil est sollicité par un autre Etat du Bassin afin de fournir à celui-ci des données ou des informations qui ne sont pas aisément disponibles, il usera de tous les moyens possibles pour satisfaire à la demande mais peut conditionner son accord au règlement par l'Etat ayant sollicité l'information des coûts raisonnablement nécessaires à la collecte et, le cas échéant, au traitement de ces données. 3. Dans l'exécution des obligations qui leur incombent aux termes des paragraphes 1 et 2 ci-dessus, les Etats du Bassin du Fleuve Nil acceptent de se conformer aux procédures qui seront développées par la Commission du Bassin du Fleuve Nil.	**ARTICLE 7** **Regular exchange of data and information** 1. In pursuance of their cooperation concerning the use, development and protection of the Nile River Basin and its water resources, Nile Basin States shall on a regular basis exchange readily available and relevant data and information on existing measures and on the condition of water resources of the Basin, where possible in a form that facilitates its utilization by the States to which it is communicated. 2. If a Nile Basin State is requested by another **Basin** State to provide data or information that is not readily available, it shall employ its best efforts to comply with the request but may condition its compliance upon payment by the requesting State of the reasonable costs of collecting and, where appropriate, processing such data or information. 3. In the implementation of their obligations under Paragraph 1 and 2, Nile Basin States agree to observe procedures to be developed by the Nile River Basin Commission.

ARTICLE 8 **Les mesures planifiées** 1. Les Etats du Bassin du Fleuve Nil s'accordent pour échanger de l'information par l'intermédiaire de la Commission du Bassin du Fleuve Nil. 3. Les Etats du Bassin du Fleuve Nil se conforment aux règles et aux procédures établies par la Commission du Bassin du Fleuve Nil pour l'échange d'information relative aux mesures planifiées.	**ARTICLE 8** **Planned measures** 1. Nile Basin States agree to exchange information through the Nile River Basin Commission. 2. Nile Basin States shall observe the rules and procedures established by the Nile River Basin Commission for exchanging information concerning planned measures.
ARTICLE 9 **Evaluation d'impact environnemental et audits** 1. Les Etats du Bassin du Fleuve Nil, procèdent, préalablement à toute mesure susceptible d'avoir des conséquences dommageables significatives sur l'environnement, à une évaluation complète de ses conséquences pour leurs propres territoires et pour les territoires des autres Etats du Bassin du Fleuve Nil. 2. Les critères et les procédures pour déterminer si une activité est susceptible d'avoir des conséquences dommageables significatives sur l'environnement seront développés par la Commission du Bassin du Fleuve Nil. 3. Lorsque les circonstances l'exigent, selon des critères qui seront développés par la Commission du Bassin du Fleuve Nil, tout Etat du Bassin du Fleuve Nil ayant mis en œuvre des mesures du type de celles évoquées au paragraphe 1 procède à un audit des impacts de ces mesures sur l'environnement. Cet Etat procède également à des consultations relatives à cet audit avec les Etats du Bassin	**ARTICLE 9** **Environmental impact assessment and audits** 1. For planned measures that may have significant adverse environmental impacts, Nile Basin States shall, at an early stage, undertake a comprehensive assessment of those impacts with regard to their own territories and the territories of other Nile Basin States. 2. The criteria and procedures for determining whether an activity is likely to have significant adverse environmental impacts shall be developed by the Nile River Basin Commission. 3. Where circumstances so warrant, according to criteria to be developed by the Nile River Basin Commission, a Nile Basin State that has implemented measures of the kind referred to in paragraph 1 shall conduct an audit of the environmental impacts of those measures. That State shall enter into consultations relating to the audit with Nile Basin States affected by the measures on their request.

du Fleuve Nil affectés par les mesures, si ceux-ci lui en font la demande. 4. La Commission adoptera des critères pour la mise en œuvre d'audits des mesures existantes à la date de l'entrée en vigueur du présent Accord, en tenant compte de la législation nationale des Etats du Bassin du Fleuve Nil. 5. Les Etats du Bassin du Fleuve Nil procèdent à des audits des mesures existantes à la date de l'entrée en vigueur du présent Accord conformément à leur législation nationale et aux critères adoptés dans le cadre de cet Accord.	4. The Commission, taking into account national legislation of the Nile Basin States, shall adopt criteria for carrying out audits of measures existing at the date of the entry into force of this Framework. 5. Nile Basin States shall carry out audits of measures existing at the date of the entry into force of this Framework in accordance with national legislation and under criteria adopted under this Framework.
Article 10 **Subsidiarité dans le développement et la protection du Bassin du Fleuve Nil** Pour la planification et la mise en œuvre d'un projet conformément au principe de subsidiarité énoncé à l'article 3(3), les Etats du Bassin du Fleuve Nil: (a) permettent à toutes les personnes sous la juridiction d'un Etat qui seront, ou sont susceptibles d'être, affectés par un projet dans cet Etat, de participer d'une manière appropriée au processus de planification et d'exécution; (b) mettent tout en œuvre pour s'assurer que le projet et tout accord qui y est relatif sont conformes au présent Accord.	**Article 10** **Subsidiarity in the development and protection of the Nile River Basin** In planning and implementing a project pursuant to the principle of subsidiarity set forth in Article 3(3) , Nile Basin States shall: (a) allow all those within a State who will or may be affected by the project in that State to participate in an appropriate way in the planning and implementation process; (b) make every effort to ensure that the project and any related agreement is consistent with the basin-wide framework.

Article 11 **Prévention et réduction des situations dommageables**	**Article 11** **Prevention and mitigation of harmful conditions**
Les Etats du Bassin du Fleuve Nil, individuellement et, conjointement en mutualisant les coûts entre les Etats du Bassin susceptibles d'être affectés, mettent tout en œuvre pour prendre toutes les mesures aptes à prévenir ou à atténuer les situations liées au système du Fleuve Nil susceptibles d'être dommageables pour d'autres Etats du Bassin du Fleuve Nil, que ces situations résultent d'activités humaines ou de causes naturelles, telles que des situations d'inondation, de présence des herbes envahissantes, de maladies d'origine hydriques, d'envasement, d'érosion, de sécheresse ou de désertification. En mettant en œuvre cette disposition, les Etats du Bassin du Fleuve Nil, tiennent compte des directives qui seront développées par la Commission du Bassin du Fleuve Nil.	Nile Basin States shall, individually and, where appropriate, jointly through cost-sharing by the Nile Basin State or States that may be affected, make every effort to take all appropriate measures to prevent or mitigate conditions related to the Nile River System that may be harmful to other Nile Basin States, whether resulting from human conduct or natural causes, such as flood conditions, invasive water weeds, water-borne diseases, siltation (silting), erosion, drought or desertification. In implementing this provision, Nile Basin States shall take into account guidelines to be developed by the Nile River Basin Commission.

Article 12 **Situations d'urgence**	**Article 12** **Emergency Situations**
1. Dans le cadre de cet article, « l'urgence » s'entend d'une situation qui cause, ou menace de causer de manière imminente un dommage sérieux aux Etats du Bassin du Fleuve Nil ou à d'autres Etats et qui résulte brusquement de causes naturelles, telles que des inondations, des éboulements ou des tremblements de terre, ou bien d'activités humaines, telles que des accidents industriels.	1. For the purposes of this provision, "emergency" means a situation that causes, or poses an imminent threat of causing, serious harm to Nile Basin States or other States and that results suddenly from natural causes, such as floods, landslides or earthquakes, or from human conduct, such as industrial accidents.
2. Tout Etat du Bassin du Fleuve Nil, prévient sans délai et par les moyens les plus rapides disponibles, les autres Etats potentiellement affectés et les organisations internationales compétentes de toute urgence prenant sa source sur son territoire.	2. A Nile Basin State shall, without delay and by the most expeditious means available, notify other potentially affected States and competent international organizations of any emergency originating in its territory.
3. Tout Etat du Bassin du Fleuve Nil sur le territoire duquel une urgence apparaît prend immédiatement toutes les mesures pratiques que les circonstances exigent afin de prévenir, d'atténuer et d'éliminer les effets dommageables de l'urgence, en coopération avec les Etats susceptibles d'être affectés et, le cas échéant, les organisations internationales compétentes.	3. A Nile Basin State within whose territory an emergency originates shall, in cooperation with potentially affected States and, where appropriate, competent international organizations, immediately take all practicable measures necessitated by the circumstances to prevent, mitigate and eliminate harmful effects of the emergency.
4. Si nécessaire, les Etats du Bassin du Fleuve Nil développent conjointement des plans de secours afin de répondre aux urgences de manière coordonnée, le cas échéant, avec d'autres Etats potentiellement affectés et les organisations internationales compétentes.	4. When necessary, Nile Basin States shall jointly develop contingency plans for responding to emergencies, in cooperation, where appropriate, with other potentially affected States and competent international organizations.

Article 13 **Protection du Bassin du Fleuve Nil et de ses infrastructures en période de conflit armé.** Le système du Fleuve Nil et les infrastructures, installations et autres ouvrages connexes, ainsi que les installations contenant des forces dangereuses dans le Bassin du Fleuve Nil sont protégés par les principes et les règles du droit international applicable en cas de conflit armé international et non-international, en particulier par les règles du droit international humanitaire, et ne doivent pas être utilisés en violation de ces principes et règles.	**Article 13** **Protection of the Nile River Basin and related installations in time of armed conflict** The Nile River System and related installations, facilities and other works, as well as installations containing dangerous forces in the Nile River Basin, shall enjoy the protection accorded by the principles and rules of international law applicable in international and non-international armed conflict, in particular rules of international humanitarian law, and shall not be used in violation of those principles and rules.
Article 14 **Sécurité de l'eau** Tenant dûment compte des dispositions des articles 4 et 5, les Etats du Bassin du Fleuve Nil reconnaissent l'importance capitale de la sécurité de l'eau pour chacun d'entre eux. Les Etats reconnaissent également que la gestion et l'aménagement coopératifs des eaux du système du Fleuve Nil faciliteront l'obtention de la sécurité de l'eau ainsi que d'autres avantages. Les Etats du Bassin du Fleuve Nil conviennent, dans un esprit de coopération, (a) d'œuvrer ensemble afin que tous les états obtiennent et maintiennent la sécurité de l'eau par tous les Etats ; (b) l' Article 14 (b) reste non résolu est transféré en annexe pour être résolu par la Commission du Bassin du Nil dans les six mois de son établissement (**Note en bas de la page**)	**Article 14** **Water Security** Having due regard to the provisions of Articles 4 and 5, Nile Basin States recognize the vital importance of water security to each of them. The States also recognize that the cooperation management and development of waters of the Nile River System will facilitate achievement of water security and other benefits. Nile Basin States therefore agree, in a spirit of cooperation: (a) to work together to ensure that all states achieve and sustain water security; (b) … the unresolved Article 14(b) is annexed to be resolved by the Nile River Basin Commission within six months of its establishment. (footnote)

PARTIE III. STRUCTURE INSTITUTIONNELLE SECTION A. LA COMMISSION DU BASSIN DU FLEUVE NIL	PART III. INSTITUTIONAL STRUCTURE SECTION A. THE NILE RIVER BASIN COMMISSION
Article 15 **Création**	**Article 15** **Establishment**
Il est créé entre les Etats du Bassin du Nil une organisation denommee Commission du Bassin du Fleuve Nil par les Etats du Bassin du Fleuve Nil.	The Nile River Basin Commission is hereby established by the Nile River Basin States.
Article 16 **Objet**	**Article 16** **Purpose and Objective**
Le but et l'objet de la Commission sont :	The purpose and objective of the Commission is:
(a) de promouvoir et de faciliter la mise en œuvre des principes, droits et obligations prévus par le présent Accord.	(a) To promote and facilitate the implementation of the principles, rights and obligations provided for in the present Framework.
(b) de servir de cadre institutionnel à la coopération des Etats du Bassin du Fleuve Nil pour l'utilisation, le développement, la protection, la conservation et la gestion du Bassin du Fleuve Nil et de ses eaux.	(b) To serve as an institutional framework for cooperation among Nile Basin States in the use, development, protection, conservation and management of the Nile River Basin and its waters.
(c) de faciliter une collaboration étroite des Etats et des peuples du Bassin du Fleuve Nil dans les domaines sociaux, économiques et culturels.	(c) To facilitate closer cooperation among the States and peoples of the Nile River Basin in the social, economic and cultural fields.

Article 17

Organes

La Commission est composée de :

(a) la Conférence des chefs d'Etat et de Gouvernement ;

(b) le Conseil des Ministres ;

(c) le Comité consultatif technique ;

(d) les Comités consultatifs sectoriels ;

(e) le Secrétariat.

Article 18

Siège

Le siège de la commission sera situé à Entebbe en Ouganda.

Article 19

Statut Juridique

1. La Commission est une organisation intergouvernementale et jouit de la personnalité juridique internationale et de la capacité juridique nécessaire pour l'exécution de ses fonctions, en particulier, de la capacité de contracter, de contracter des obligations, de recevoir des donations, d'ester en justice activement et passivement.

Article 17

Organs

The Commission is comprised of:

(a) Conference of Heads of State and Government

(b) Council of Ministers

(c) Technical Advisory Committee

(d) Sectoral Advisory Committees

(e) Secretariat

Article 18

Headquarters

The headquarters of the Commission shall be situated in Entebbe, Uganda.

Article 19

Legal Status

1. The Commission is established as an intergovernmental organization and shall enjoy international legal personality, with such legal capacity as may be necessary for the performance of its functions, in particular, the capacity to enter into agreements, to incur obligations, to receive donations, and to sue and be sued in its own name.

2. La Commission et son personnel bénéficient, sur le territoire de chaque Etat du Bassin du Fleuve Nil, des privilèges et des immunités nécessaires pour l'exécution des fonctions qui leur incombent aux termes du présent Accord. 3. Les privilèges et les immunités visés à cet article seront détaillés dans un protocole à cet Accord.	2. The Commission and its officials shall, in the territory of each Nile Basin State, enjoy such privileges and immunities as are necessary for the performance of their functions under this Framework. 3. The privileges and immunities referred to under this article shall be provided for in detail in a Protocol to this Framework.
SECTION B. LA CONFÉRENCE DES CHEFS D'ETAT OU DE GOUVERNEMENT	**SECTION B. THE CONFERENCE OF HEADS OF STATE AND GOVERNMENT**
Article 20 **Structure et procédures**	**Article 20** **Structure and Procedures**
1. La conférence des chefs d'Etat et des gouvernements (« la Conférence ») est composée des chefs d'Etat ou de Gouvernement des Etats du Bassin du Fleuve Nil. 2. La conférence établit son propre règlement et ses procédures.	1. The Conference of Heads of State and Government ("the Conference") is composed of Heads of State and Government of Nile Basin States. 2. The Conference shall establish its own rules and procedures.
Article 21 **Fonctions**	**Article 21** **Functions**
La conférence est l'organe suprême de décision de la Commission.	The Conference shall be the supreme policy-making organ of the Commission.

SECTION C. LE CONSEIL DES MINISTRES	SECTION C. THE COUNCIL OF MINISTERS
Article 22 **Structure**	**Article 22** **Structure**
Le Conseil des Ministres (« le Conseil ») sera composé des Ministres des Ressources en Eau de chaque Etat du Bassin du Fleuve Nil et d'autres Ministres en fonction de l'ordre du jour de la Commission.	The Council of Ministers (the "Council") shall be composed of the Minister for Water Affairs of each Nile Basin State and other ministers according to the agenda of the Commission.
Article 23 **Procédures**	**Article 23** **Procedures**
1. Sauf exception, le Conseil établit son propre règlement et ses propres procédures.	1. Except as otherwise provided, the Council shall establish its own rules and procedures.
2. Le Conseil se réunit une fois par an en session régulière et en session spéciale à la demande de tout Etat du Bassin du Fleuve Nil.	2. The Council shall convene once a year in regular session and in special session at the request of any Nile Basin State.
3. À moins qu'il n'en décide autrement, le Conseil se réunit en session régulière successivement dans chacun des Etats du Bassin du Fleuve Nil selon l'ordre alphabétique, en anglais. Le lieu de chaque session spéciale est identique à celui de la session régulière précédente.	3. Unless the Council decides otherwise, the venue of regular sessions shall rotate among the Nile Basin States in alphabetical order, in English. The venue of a special session shall be the same as that of the preceding regular session.
4. Les sessions régulières sont présidées par l'Etat sur le territoire duquel elles sont tenues. Les sessions spéciales sont présidées par l'Etat qui a présidé la session régulière précédente.	4. Regular sessions shall be chaired by the Nile Basin State in which they are held. Special sessions shall be chaired by the State that chaired the next preceding regular session.

5. Les décisions du Conseil sont prises par consensus.	5. Decisions of the Council shall be taken by consensus.
6. Les décisions du Conseil sont contraignantes pour tous les Etats du Bassin du Fleuve Nil.	6. Decisions of the Council are binding on all Nile Basin States.
Article 24 **Fonctions**	**Article 24** **Functions**
1. Le Conseil est l'organe directeur de la Commission. Il peut renvoyer des questions à la Conférence des chefs d'Etat pour décision.	1. The Council is the governing body of the Commission. It may refer matters to the Conference of Heads of State for decision.
2. Le Conseil sert de forum de discussion pour les questions relevant de ses fonctions et du présent Accord.	2. The Council serves as a forum for discussion of matters within the scope of its functions and the Framework.
3. Le Conseil surveille l'exécution efficace de cet Accord.	3. The Council oversees the effective implementation of the Framework.
4. Le Conseil peut établir, et assigner des responsabilités à tous les comités ad hoc qu'il considère nécessaires pour la réalisation de ses fonctions.	4. The Council may establish, and assign responsibilities to any ad hoc committees it considers to be necessary for the proper fulfillment of its functions.
5. Le Conseil adopte, revoit et, le cas échéant, met à jour, les plans pour la gestion et le développement coordonnés, intégrés, et durables du Bassin du Fleuve Nil.	5. The Council adopts, keeps under review and revises as necessary, plans for the coordinated, integrated, and sustainable management and development of the Nile River Basin.
6. Le Conseil approuve les programmes de travail annuels de la Commission.	6. The Council approves the annual work programs of the Commission.
7. Le Conseil assure la durabilité financière de la Commission.	7. The Council ensures the financial sustainability of the Commission.
8. Le Conseil approuve le règlement et les procédures régissant le fonctionnement du Comité consultatif technique, des Comités consultatifs sectoriels, et du Secrétariat, ainsi que son programme de travail et les règles relatives à la gestion financière et au personnel de la Commission.	8. The Council approves rules and procedures governing the operations of the Technical Advisory Committee, Sectoral Advisory Committees, and the Secretariat, as well

	as its work program and financial and staff regulations.
9. Le Conseil nomme le Secrétaire Exécutif et les autres cadres supérieurs de la Commission.	9. The Council appoints the Executive Secretary and other senior staff of the Commission.
10. Le Conseil suit de prêt la structure organisationnelle du Secrétariat et son personnel.	10. The Council makes determinations concerning the staffing and organizational structure of the Secretariat.
11. Le Conseil adopte, revoit et, le cas échéant, met à jour les règlements, procédures, directives et critères pour la mise en œuvre des dispositions de cet Accord.	11. The Council adopts, keeps under review and revises as necessary, rules, procedures, guidelines and criteria for the implementation of the provisions of this Framework.
12. Le Conseil examine et prend des décisions définissant l'utilisation équitable et raisonnable de l'eau dans chaque pays riverain en prenant en compte les facteurs visés à l' article 4, paragraphe 2.	12. The Council examines and makes decisions regarding the determination of equitable and reasonable use of water in each riparian country taking into consideration the factors provided in Article 4, paragraph 2.
13. A la demande des Etats concernés, le Conseil examine les questions et les différences d'opinion pouvant s'élever parmi les Etats du Bassin du Fleuve Nil au sujet de l'interprétation ou de l'application de cet Accord. Il peut faire des recommandations aux Etats concernés en ce qui concerne ces questions ou différences d'opinion.	13. At the request of the States concerned, the Council addresses questions and differences that may arise between Nile Basin States concerning the interpretation or application of the Framework. It may make recommendations to the States concerned with regard to such questions and differences.
14. Le Conseil favorise l'application complète et effective de cet Accord.	14. The Council promotes the full and effective application of the Framework.
15. Le Conseil établit une échelle pondérée des contributions des Etats du Bassin du Fleuve Nil au financement du budget de la Commission, et approuve le budget de la Commission.	15.The Council decides upon a sliding scale of contributions of Nile Basin States for the financing of the budget of the Commission, and approves the budget of the Commission.
16. Le cas échéant, le Conseil établit des formules pour le partage entre les Etats du Bassin du Fleuve Nil, des coûts et des bénéfices liés à des projets communs particuliers dans le Bassin du Fleuve Nil.	16.Where appropriate, the Council decides upon formulas for cost and benefit sharing by Nile Basin States in respect of particular joint projects within the Nile River Basin.

17. Le Conseil remplit les autres fonctions qui lui semblent nécessaires à la réalisation des buts de la Commission..	17. The Council performs such other functions in the effectuation of the purposes of the Commission as it may decide.
SECTION D. LE COMITÉ CONSULTATIF TECHNIQUE	**SECTION D. THE TECHNICAL ADVISORY COMMITTEE**
Article 25	**Article 25**
Structure et procédures	**Structure and Procedures**
1. Le Comité consultatif technique (le "CCT") sera composé de deux membres nommés par chaque Etat du Bassin du Fleuve Nil qui sont des hauts fonctionnaires de l'Etat. Les délégués peuvent se faire accompagner d'autres experts aux réunions du CCT, selon les besoins, pour traiter de questions spéciales.	1. The Technical Advisory Committee (the "TAC") shall be composed of two members from each Nile Basin State who shall be senior officials. Delegates may bring other experts to meetings of the TAC as necessary to deal with special questions.
2. Le CCT peut établir des groupes de travail spécialisés pour traiter de sujets relevant de ses compétences.	2. The TAC may establish specialized Working Groups to deal with matters within its competence.
3. Le CCT se réunit deux fois par an en session régulière, et en session spéciale à la demande du Conseil, exprimée par son président. Sauf décision contraire, les sessions se tiennent au siège de la Commission.	3. The TAC shall convene twice a year in regular session, and in special session if and as the Council, through its Chair, so requests. Unless otherwise decided, the venue for sessions shall be the headquarters of the Commission.
4. Le CCT propose à l'approbation du Conseil ses propres règlements et procédures.	4. The TAC shall propose, for the approval of the Council, its own rules and procedures.

Article 26	Article 26
Fonctions	**Functions**
1. Le CCT prépare et soumet au Conseil des programmes de coopération pour la gestion et le développement intégrés et durables du Bassin du Fleuve Nil.	1. The TAC shall prepare for the consideration of the Council cooperative programs for the integrated and sustainable management and development of the Nile River Basin.
2. Sur la base de rapports du secrétariat, le CCT fait des recommandations au Conseil au sujet des programmes de travail annuels et du budget de la Commission.	2. On the basis of reports from the Secretariat, the TAC shall make recommendations to the Council concerning annual work programs and budget of the Commission.
3. Le CCT propose au Conseil les règlements, procédures, directives et critères prévus dans le présent Accord.	3. The TAC shall propose to the Council rules, procedures, guidelines and criteria provided for in this Framework.
4. Le CCT fait des recommandations au Conseil sur la mise en œuvre des dispositions de cet Accord.	4. The TAC shall make recommendations to the Council on the implementation of the provisions of this Framework.
5 .Le CCT fait des recommandations au Conseil sur les décisions définissant l'utilisation équitable et raisonnable de l'eau dans chaque pays riverain, en prenant en compte les facteurs visés à l'article 4, paragraphe 2.	5. The TAC shall make recommendations to the Council on decisions regarding the determination of equitable and reasonable use of water in each riparian country taking into consideration the factors provided in Article 4, paragraph 2.
6. Le CCT conseille le Conseil sur les sujets techniques relatifs à l'utilisation, au développement, à la protection, à la conservation et à la gestion du Bassin du Fleuve Nil et du système du Fleuve Nil, notamment la protection contre la sécheresse et les inondations.	6. The TAC shall advise the Council on technical matters relating to the use, development, protection, conservation and management of the Nile River Basin and the Nile River System, including protection from drought and floods.
7. Le CCT fait des propositions au Conseil pour la nomination du Secrétaire Exécutif et du personnel technique du secrétariat ; il supervise le secrétariat.	7. The TAC shall make proposals to the Council concerning appointment of the Executive Secretary and senior technical staff of the Secretariat, and supervises the Secretariat.
8. Le CCT fait des recommandations au Conseil au sujet des règlements et procédures régissant le fonctionnement du secrétariat, ainsi que de son programme de travail.	8. The TAC shall make recommendations to the Council concerning rules and procedures governing the operations of the Secretariat, as well as its work program.
9. A la demande du Conseil, le CCT fait des recommandations à celui-ci au sujet de la modification de l'Accord ou de l'élaboration de protocoles annexes.	9. When directed to do so by the Council, the TAC shall make recommendations to the Council concerning the modification of the Framework or the elaboration of protocols.
10. Le CCT remplit les autres fonctions qui lui sont, le cas échéant, confiées par le Conseil.	10. The TAC shall perform such other functions as may from time to time be assigned to it by the Council

SECTION E. COMITÉS CONSULTATIFS SECTORIELS	**SECTION E. SECTORAL ADVISORY COMMITTEES**
Article 27 **Structure et procédures**	**Article 27** **Structure and Procedures**
1. Des Comités consultatifs sectoriels ("CCS") peuvent être créés par le Conseil afin de traiter de sujets sectoriels spécifiques relevant de la compétence de la Commission.	1. Sectoral Advisory Committees (“SACs”) may be established by the Council to deal with specific sectoral matters within the competence of the Commission.
2. Sauf décision contraire du Conseil, un CCS est composé d'un membre nommé par chaque Etat du Bassin du Fleuve Nil, expert dans le domaine d’activité du CCS concerné.	2. Unless the Council decides otherwise, a SAC shall be composed of one member from each Nile Basin State who is an expert in the field of activity of the SAC in question.
3. Les règlements et procédures applicables au CCT sont applicables, *mutatis mutandis*, aux CCS.	3. SACs shall be governed by the rules and procedures applicable to the TAC, mutatis mutandis.
4. Le Conseil peut mettre en place un CCS chargé d'établir la liaison entre les organisations couvrant une partie seulement du Bassin du Fleuve Nil et la Commission.	4. The Council may establish a SAC charged with establishing linkage between sub-basin organizations and the Commission.
Article 28 **Fonctions**	**Article 28** **Functions**
Les CCS remplissent les fonctions qui leur sont assignées par le Conseil.	SACs shall discharge the tasks assigned to them by the Council.

SECTION F. LE SECRÉTARIAT	SECTION F. THE SECRETARIAT
Article 29 **Structure**	**Article 29** **Structure**
1. Le secrétariat est dirigé par un Secrétaire Exécutif nommé par le Conseil pour trois ans.	1. The Secretariat shall be headed by an Executive Secretary who shall be appointed for a three year term by the Council.
2. Le Secrétaire Exécutif rend des comptes au Conseil, à travers le CCT.	2. The Executive Secretary shall be accountable to the Council through the TAC.
3. Le Secrétaire Exécutif et le personnel du Secrétariat Bénéficient des privilèges et immunités nécessaires à l'exercice de leurs fonctions dans les Etats du Bassin du Fleuve Nil.	3. The Executive Secretary and the officials of the Secretariat shall enjoy in Nile Basin States the privileges and immunities necessary for the performance of their functions.
4. Le Conseil décide du personnel et de la structure du secrétariat selon le principe d'une distribution géographique équitable et sur recommandation du CCT.	4. The staff and structure of the Secretariat shall be determined by the Council on the recommendation of the TAC, taking into account the principle of geographic distribution.
5. Le bureau du secrétariat est situé au siège de la Commission.	5. The office of the Secretariat shall be situated at the Headquarters of the Commission.

Article 30 Fonctions	Article 30 Functions
1 Le Secrétaire Exécutif représente la Commission dans les matières indiquées dans les règlements et procédures régissant son fonctionnement et en particulier dans les relations de celle-ci avec les institutions internationales et bilatérales [SIC] d'assistance et avec toutes les institutions ou arrangements couvrant une partie seulement du Bassin du Fleuve Nil.	1. The Executive Secretary shall represent the Commission as to matters specified in the rules and procedures governing its operations and in particular in its relations with international and bilateral assistance institutions and with any Nile sub-basin institutions or arrangements.
2. Le secrétariat assure le secrétariat des réunions de tous les organes de la Commission.	2. The Secretariat shall serve as the secretariat for meetings of all organs of the Commission.
3. Le Secrétaire Exécutif est responsable de l'administration et des finances de la Commission.	3. The Executive Secretary shall be responsible for the administration and finances of the Commission.
4. Le Secrétaire Exécutif prépare et soumet au CCT des rapports relatifs aux programmes de travail annuels de la Commission ; il tient compte pour cela des informations qui lui sont fournies par les institutions de référence pour le Nil au sein de chaque Etat.	4. The Executive Secretary shall prepare, taking into account any information provided by National Nile Focal Point Institutions, and shall submit reports to the TAC concerning the annual work programs of the Commission.
5. Le Secrétaire Exécutif établit le budget prévisionnel de la Commission et le soumet au CCT.	5. The Executive Secretary shall prepare a proposed budget of the Commission and submits it to the TAC.
6. Le Secrétaire Exécutif est responsable de la mise en œuvre d'études et d'autres activités proposées par le CCT et autorisées par le Conseil. Le Secrétaire Exécutif peut, avec l'accord du CCT, engager des consultants afin de l'assister dans ces tâches.	6. The Executive Secretary shall be responsible for the carrying out of studies and the performance of other activities proposed by the TAC and authorized by the Council. The Executive Secretary may engage consultants with the approval of the TAC to assist in the performance of these functions.
7. Le secrétariat assiste le CCT dans la préparation d'un plan pour la gestion et le développement coordonnés, intégrés, et durables du Bassin du Fleuve Nil.	7. The Secretariat shall assist the TAC with the preparation of a plan for the coordinated, integrated, and sustainable management and development of the Nile River Basin.

8. Le secrétariat assiste tous les organes de la Commission, à leur demande, dans l'exercice de leurs fonctions. 9. Le secrétariat rassemble les données et les informations disponibles et coordonne la surveillance de toute information relative au Bassin du Fleuve Nil, notamment les informations relatives aux ressources en eau, à l'environnement et aux problèmes socio-économiques ; il passe en revue et synthétise ces information dans l'optique de leur intégration dans des bases de données couvrant l'ensemble du Bassin et de la création de normes ; il développe des mécanismes permettant l'échange régulier d'informations dans les domaines pertinents 10. Le secrétariat reçoit les rapports d'organisations couvrant une partie seulement du Bassin et les transmet au CCT. 11. Le secrétariat remplit toutes les autres fonctions qui lui sont assignées par le CCT.	8. The Secretariat shall provide other assistance to all organs of the Commission, on their request, concerning matters related to the discharge of their functions. 9. The Secretariat shall compile available data and information and coordinates monitoring of information relating to the Nile Basin, including information concerning water resources, the environment and socio-economic matters, reviews and synthesizes the information with a view to integrating it into basin-wide databases and establishing standards, and develops mechanisms for the regular exchange of information where needed. 10. The Secretariat shall receive reports from sub-basin organizations and transmits the reports to TAC for its consideration. 11. The Secretariat shall perform any other functions assigned to it by the TAC.

SECTION G. **SUCCESSION DE LA COMMISSION DU BASSIN DU FLEUVE NIL À L'INITIATIVE DU BASSIN DU NIL** **Article 30** **Succession** A l'entrée en vigueur du présent Accord, la Commission succédera à l'Initiative du Bassin du Nil (IBN) pour tous les droits, obligations et patrimoine.	**SECTION G.** **SUCCESSION OF THE NILE RIVER BASIN COMMISSION TO THE NILE BASIN INITIATIVE** **Article 30** **Succession** Upon the entry into force of this Framework the Commission shall succeed to all rights, obligations and assets of the Nile Basin Initiative (NBI).

PARTIE IV. INSTITUTIONS SUBSIDIAIRES	PART IV. SUBSIDIARY INSTITUTIONS
Article 31 **Organisations et accords des sous-bassins**	**Article 31** **Sub-Basin organizations and arrangements**
1. Les Etats du Bassin du Fleuve Nil reconnaissent l'utilité des organisations et des institutions couvrant les sous-bassins du Nil.	1. Nile Basin States shall recognize the utility of sub-basin organizations and arrangements.
2. Les parties au cadre qui sont également membres d'organisations, ou parties à des accords, couvrant une partie seulement du Bassin s'assurent que les buts, les fonctions et les activités de ces organisations et accords sont conformes à ceux de la Commission du Bassin du Fleuve Nil et avec les principes et les règlements élaborés ou adoptés dans le cadre du présent Accord.	2. The parties to the Framework that are also members of sub-basin organizations or arrangements shall undertake to ensure that the purposes, functions and activities of such organizations and arrangements are consistent with those of the Nile River Basin Commission and with the principles and rules set out in, or adopted under, the Framework.
3. Les parties à cet Accord qui sont également membres d'organisations, ou parties à des accords, couvrant une partie seulement du Bassin s'assurent également que ces organisations ou accords fonctionnent en collaboration étroite avec la Commission du Bassin du Fleuve Nil.	3. The parties to the Framework that are also members of sub-basin organizations or arrangements further undertake to ensure that such organizations or arrangements work in close cooperation with the Nile River Basin Commission.
4. La Commission du Bassin du Fleuve Nil maintiendra un contact régulier et coopérera étroitement, avec toute organisation ou institution liée à un accord couvrant une partie du Bassin.	4. The Nile River Basin Commission shall maintain regular contact, and shall cooperate closely, with any sub-basin organization or arrangement.

Article 32 Institutions nationales point focal du le Nil	Article 32 National Nile Focal Point Institutions
1. Chaque Etat du Bassin du Fleuve Nil crée ou désigne une institution nationale point focal du Nil et en informe la Commission.	1. Each Nile Basin State shall establish or designate a National Nile Focal Point Institution and notify the Commission thereof.
2. Les institutions nationales point focal du Nil ont pour fonction de servir de points de référence nationaux pour la Commission pour les problèmes relevant de la compétence de celle-ci.	2. The function of National Nile Focal Point Institutions shall serve as national focal points for the Commission with regard to matters within the competence of the Commission.

PARTIE V. DISPOSITIONS DIVERSES **Article 33** **Règlement des différends**	**PART V. MISCELLANEOUS PROVISIONS** **Article 33** **Settlement of disputes**
1. En cas de différend entre deux Etats ou plus du Bassin du Fleuve Nil concernant l'interprétation ou l'application du présent Accord, les Etats concernés règlent leur différend par des moyens pacifiques et conformément aux dispositions suivantes, sauf convention contraire :	1. In the event of a dispute between two or more Nile Basin States concerning the interpretation or application of the present Framework, the States concerned shall, in the absence of an applicable agreement between them, seek a settlement of the dispute by peaceful means in accordance with the following provisions:
a. Si les Etats concernés ne parviennent pas à conclure un accord par la voie de négociations initiées par l'un d'eux, ils peuvent solliciter conjointement les bons offices, la médiation ou la conciliation de la Commission du Bassin du Fleuve Nil ou d'un autre tiers ; ils peuvent, alternativement, convenir de soumettre le différend à l'arbitrage, conformément aux procédures adoptées par le Conseil, ou à la Cour internationale de Justice.	a. If the States concerned cannot reach agreement by negotiation requested by one of them, they may jointly seek good offices, or request mediation or conciliation by, the Nile River Basin Commission or other third party, or agree to submit the dispute to arbitration, in accordance with procedures to be adopted by the Council, or to the International Court of Justice.
b. Si à l'écoulement d'un délai de six mois à compter de la demande de négociations visée au paragraphe 2, les Etats concernés ne sont pas parvenus à résoudre leur différend par le biais de négociations ou de tout autre moyen visé au paragraphe 2, le différend est soumis, à la demande de la parties la plus diligente, à une procédure impartiale d'établissement des faits, conformément à l'annexe au présent Accord, sauf accord contraire des Etats concernés.	b. If after six months from the time of the request for negotiations referred to in paragraph 2, the States concerned have not been able to settle their dispute through negotiation or any other means referred to in paragraph 2, the dispute shall be submitted, at the request of any of the parties to the dispute, to impartial fact-finding in accordance with the Annex on the fact-finding Commission, unless the States concerned otherwise agree.

Article 34 **Conventions complémentaires** 1. Les Etats du Bassin du Fleuve Nil peuvent conclure des conventions bilatérales ou multilatérales complétant le présent Accord relativement à certaines parties du Bassin du Fleuve Nil ou du système du Fleuve Nil, tels que des sous-bassins et des affluents, ou relativement à des projets spécifiques ou à des programmes en rapport avec le Bassin du Fleuve Nil, le système du Fleuve Nil, une portion de ce Bassin ou une portion de ce système. 2. Les conventions complémentaires visées au paragraphe 1 mettent en œuvre les principes posés par le présent Accord dans les domaines concernés. 3. Les Etats du Bassin du Nil s'engagent à ne pas conclure d'accord ou de convention incompatible avec les dispositions du présent Accord.. 4. Des conventions complémentaires peuvent être adoptées par consensus par les Etats du Bassin du Fleuve Nil sous la forme de protocoles au présent Accord.	**Article 34** **Supplementary instruments** 1. Nile Basin States may adopt bilateral or multilateral instruments that supplement the present Framework, concerning portions of the Nile River Basin or the Nile River system, such as sub-basins and tributaries, or concerning individual projects or programs relating to the Nile River Basin or the Nile River system, or portions thereof. 2. The supplementary instruments referred to in paragraph 1 shall apply the principles of the present Framework to the subject matter of those instruments. 3. Any other instruments or arrangements entered into by the Nile Basin States shall not be inconsistent with the provisions of the present Framework. 4. Supplementary instruments may be adopted as Protocols to the present Framework by consensus by Nile Basin States.

PARTIE VI. CLAUSES FINALES	PART VI. FINAL CLAUSES
Article 35	**Article 35**
Amendement du cadre ou des protocoles	**Amendment of the Framework or Protocols**
1. Toute partie au présent Accord peut y proposer des amendements. Les Amendements aux protocoles peuvent être proposés par toute partie au protocole concerné.	1. Amendments to this Framework may be proposed by any State Party. Amendments to any protocol may be proposed by any State to that protocol.
2. Les amendements au présent Accord sont adoptés lors d'une réunion des parties. Les amendements à un protocole qui y est annexé sont adoptés lors d'une réunion des parties au protocole concerné.	2. Amendments to this Framework shall be adopted at a meeting of the State Parties. Amendments to any protocol shall be adopted at a meeting of the State Parties to the Protocol in question.
3. Les articles 1, 2, 3, 4, 5, 8, 9, 14 (Sécurité de l'eau), 23, 24, 33, et 34 du présent Cadre ne peuvent être amendés que par consensus. Quant aux propositions d'amendements à l'Accord ou à un protocole,les parties mettent tout en œuvre pour parvenir à un consensus. En cas d'échec, la proposition d'amendement peut être adoptée, en dernier recours, par une majorité des deux tiers des parties à l'instrument concerné présentes et votantes, puis soumises par l'autorité dépositaire à toutes les parties pour ratification, acceptation ou approbation.	3. Articles 1, 2, 3, 4, 5, 8, 9, 14 Water Security, 23, 24, 33, and 34 of the present Framework may be amended only by consensus. As to proposed amendments to other articles or to any protocol, the Parties shall make every effort to reach agreement by consensus. If all efforts at consensus have been exhausted, and no agreement reached, the amendment shall as a last resort be adopted by a two-thirds majority vote of the State Parties to the instrument in question present and voting at the meeting, and shall be submitted by the Depositary to all State Parties for ratification, acceptance or approval.

Article 36 **Adoption et amendement des annexes**	**Article 36** **Adoption and Amendment of Annexes**
1. Les annexes au présent Accord ou à tout protocole qui lui est annexé font partie intégrante dudit accord ou dudit protocole. Sauf précision contraire, toute référence au présent Accord ou à ses protocoles annexes constitue dans le même temps une référence à toutes leurs annexes. Ces annexes concernent exclusivement des problèmes d'ordre procédural, scientifique, technique ou administratif.	1. The annexes to this Framework or to any protocol shall form an integral part of the Framework or of such protocol, as the case may be, and, unless expressly provided otherwise, a reference to this Framework or its protocols constitutes at the same time a reference to any annexes thereto. Such annexes shall be restricted to procedural, scientific, technical and administrative matters agreed upon by the parties.
2. Sauf disposition contraire d'un protocole pour ce qui concerne ses propres annexes, la proposition, l'adoption et l'entrée en vigueur de nouvelles annexes au présent Accord ou aux protocoles respectent la procédure suivante :	2. Except as may be otherwise provided in any protocol with respect to its annexes, the following procedure shall apply to the proposal, adoption and entry into force of additional annexes to this Framework or of annexes to any protocol:
(a) les annexes au présent Accord ou à tout protocole sont proposées et adoptées conformément à la procédure prévue à l'article 35. En particulier, toute annexe relative à l'un des articles cités au paragraphe 3 de l'article 35, laquelle ne peut être amendée que par consensus, doit être adoptée par consensus.	(a) Annexes to this Framework or to any protocol shall be proposed and adopted according to the procedure laid down in Article 35. In particular, any annex relating to one of the articles listed in paragraph 3 of Article 35, which may be amended only by consensus, must be adopted by consensus;
(b) Toute partie signifie à l'autorité dépositaire son éventuel refus de la proposition d'annexe à l'Accord ou à un protocole, par écrit et dans un délai d'un an à compter de la notification de l'adoption de l'annexe par l'autorité dépositaire. L'autorité dépositaire transmet sans délai l'information de cette déclaration de refus à toutes les parties. Une partie peut à tout moment retirer sa déclaration de refus et les annexes rentrent alors immédiatement en vigueur conformément au sous-paragraphe (c) ci-dessous ;	(b) Any Party that is unable to approve an additional annex to this Framework or an annex to any protocol to which it is Party shall so notify the Depositary, in writing, within one year from the date of the communication of the adoption by the Depositary. The Depositary shall without delay notify all Parties of any such declaration of objection received. A Party may at any time withdraw a previous declaration of objection and the annexes shall thereupon enter into force for that Party subject to subparagraph (c) below;
(c) A l'expiration d'un délai d'un an à compter de la notification par l'autorité dépositaire de l'adoption de	(c) On the expiry of one year from the date of the communication of the adoption by the Depositary, the

l'annexe, l'annexe entre en vigueur pour toutes les parties au présent Accord ou au protocole concerné, sous réserve que ces parties n'aient pas émis la déclaration de refus visée au sous-paragraphe (b) ci-dessus.	annex shall enter into force for all Parties to this Framework or to any protocol concerned which have not submitted a notification in accordance with the provisions of subparagraph (b) above.
3. La proposition, l'adoption et l'entrée en vigueur des amendements aux annexes au présent Accord ou à un protocole sont soumises à la même procédure que la proposition, l'adoption et l'entrée en vigueur des annexes elles-mêmes.	3. The proposal, adoption and entry into force of amendments to annexes to this Framework or to any protocol shall be subject to the same procedure as for the proposal, adoption and entry into force of annexes to the Framework or annexes to any protocol.
. 4. Si une annexe supplémentaire ou un amendement à une annexe est lié(e) à un amendement au présent Accord ou à un protocole spécifique, il (elle) n'entre pas en vigueur avant l'entrée en vigueur de l'amendement concerné.	4. If an additional annex or an amendment to an annex is related to an amendment to this Framework or to any protocol, the additional annex or amendment shall not enter into force until such time as the amendment to the Framework or to the protocol concerned enters into force.
Article 37	**Article 37**
Relation entre le présent Accord et ses protocoles annexés	**Relationship between this Framework and Its Protocols**
1. Un Etat ne peut devenir partie à un protocole annexe au présent Accord que s'il est, ou devient à la même occasion, partie au présent Accord.	1. A State may not become a party to a protocol to this Framework unless it is, or becomes at the same time, a party to this Framework.
2. Les décisions prises dans le cadre d'un protocole annexé au présent Accord sont prises par les parties à ce protocole exclusivement. Tout Etat du Bassin du Fleuve Nil n'ayant pas ratifié le protocole concerné peut participer en tant qu'observateur à toute réunion des parties à ce protocole.	2. Decisions under any protocol shall be taken only by the Parties to the protocol concerned. Any Nile Basin State that has not ratified a protocol may participate as an observer in any meeting of the parties to that protocol.

Article 38 **Réserves** Aucune réserve ne peut être faite au présent Accord.	**Article 38** **Reservations** No reservations may be made to this Framework.
Article 39 **Retrait**	**Article 39** **Withdrawal**
1. Les parties au présent Accord peuvent s'en retirer à tout moment, par avis écrit adressé à l'autorité dépositaire, après l'écoulement d'un délai de deux ans à compter de l'entrée en vigueur de cet Accord à leur égard.	1. At any time after two years from the date on which this Framework has entered into force for a State Party, that State Party may withdraw from the Framework by giving written notification to the Depositary.
2. Le retrait est effectif à l'expiration d'un délai d'un an à compter de la réception par l'autorité dépositaire, ou à une date ultérieure indiquée dans la notification du retrait, jusqu'à quoi l'Etat concerné continue à être tenu par le présent Accord.	2. Any such withdrawal shall take place upon expiry of one year after the date of its receipt by the Depositary, or on such later date as may be specified in the notification of the withdrawal, during which period the notifying State shall continue to be bound by the Framework.
3. Le retrait d'une partie du présent Accord entraîne retrait de tous les protocoles annexés et annexes à celui-ci.	3. Any State Party which withdraws from this Framework shall be considered as also having withdrawn from any protocol and annex to which it is party.
4. Toute partie doit, avant de se retirer, liquider l'ensemble des obligations qui lui incombent aux termes de cet Accord.	4. Any State Party which withdraws from this Framework shall, before withdrawing, settle its outstanding obligations thereunder.
5. Les dispositions de cet article s'appliquent au retrait des protocoles annexés au présent Accord.	5. The provisions of this article shall apply to withdrawal from protocols to the Framework.

Article 40 **Signature** Le présent Accord est ouvert à la signature de tous les Etats sur le territoire desquels est située une partie du Bassin du Fleuve Nil, du 1er août 2009 au 1er août 2011 à Entebbe, Ouganda.	**Article 40** **Signature** The present Framework shall be open for signature by all States in whose territory part of the Nile River Basin is situated, from 1st of August 2009 to 1st of August 2011 in Entebbe, Uganda.
Article 41 **Ratification ou adhésion** Tous les Etats sur le territoire desquels est situé une partie du Bassin du Fleuve Nil peuvent ratifier le présent Accord ou y adhérer. Les instruments de ratification ou d'accession sont déposés auprès de l'Union Africaine.	**Article 41** **Ratification or Accession** The present Framework is subject to ratification or accession by all States in whose territory part of the Nile River Basin is situated. The instruments of ratification or accession shall be deposited with the African Union.
Article 42 **Entrée en vigueur** Le présent Accord entre en vigueur le soixantième jour suivant la date du dépôt du sixième instrument de ratification ou d'accession auprès de l'Union Africaine.	**Article 42** **Entry into Force** The present Framework shall enter into force on the sixtieth day following the date of the deposit of the sixth instrument of ratification or accession with the African Union.
Article 43 **Textes authentiques, autorité dépositaire** L'original du présent accord, dont les textes anglais et français font également foi, est déposé auprès de l'Union Africaine, qui en fait parvenir des copies certifiées conformes aux Parties contractantes.	**Article 43** **Authentic Texts, Depositary** The original of the present Framework, of which the English and French texts are equally authentic, shall be deposited with the African Union, which shall send certified true copies thereof to the State Parties.

Article 44 **Fonctions de l'autorité dépositaire**	**Article 44** **Functions of the Depositary**
L'autorité dépositaire, en particulier, informe les parties :	The Depositary shall, in particular, inform the State Parties:
a) du dépôt des instruments de ratification ou d'accession, ou de toute autre information, de déclarations ou d'autres instruments prévus dans le présent Accord ;	(a) Of the deposit of instruments of ratification or accession, or of any other information, declarations or other instruments provided for in the present Framework.
(b) de la date de l'entrée en vigueur du présent Accord.	(b) Of the date of the entry into force of the present Framework.
EN FOI DE QUOI : les plénipotentiaires soussignés, à ce dûment autorisés, ont signé le présent Accord.	IN WITNESS WHEREOF the undersigned plenipotentiaries, being duly authorized by their respective Governments, have signed the present Framework.

Fait à _____, le ___ Mois _____, 2009.	**Done at _____, this ___ day of _____, 2009.**
……..…… Nom, Titre et Ministère, Burundi Ministère,	……..…… Name, title and Ministry, Burundi
……..…… Nom, Titre et R.D. Congo	… …… …… Name, title and Ministry, D.R. Congo
……..…… Nom, Titre et Ministère, Egypte	……..…… Name, title and Ministry, Egypt
…… Nom, Titre et Ministère, Erythrée	……. Name, title and Ministry, Eritrea
……..…… Nom, Titre et Ministère, Ethiopie	……..…… Name, title and Ministry, Ethiopia
… …… Nom, titre et Ministère, Kenya	…… Name, title and Ministry Kenya
……..…… Nom, titre et Ministère, Rwanda	……..…… Name, title and Ministry, Rwanda
. …. …… Nom, titre et Ministère, Soudan	…….. Name, title and Ministry Sudan
…… Nom, titre et Ministère, Tanzania	…… Name, title and Ministry, Tanzania
…… Nom, titre et Ministère Ouganda	…… Name, title and Ministry, Uganda

Annexe	Annex
La Commission d'établissement des faits	**Fact-Finding Commission**
1. Une Commission d'établissement des faits est créée. Elle est, composée d'un membre nommé par chaque Etat concerné et d'un membre n'ayant la nationalité d'aucun Etat concerné, ce dernier étant choisi par les membres nommés pour siéger en qualité de Président de la commission.	1. A Fact-finding Commission shall be established, composed of one member nominated by each State concerned and in addition a member not having the nationality of any of the States concerned chosen by the nominated members who shall serve as Chairman.
2. Si les membres nommés par les Etats ne parviennent pas à s'entendre sur la nomination d'un Président dans les trois mois suivant la requête de constitution de la Commission, tout Etat intéressé peut inviter le président de la Commission de l'Union Africaine (UA) à nommer un Président qui n'aura la nationalité d'aucune des parties au différend, ni d'aucun des Etats du Bassin du Fleuve Nil concernés. Si l'un des Etats ne nomme pas le membre qu'il doit désigner dans les trois mois de la requête initiale visée au paragraphe 2 de l'article 33 ci-dessus, tout Etat intéressé peut inviter le président de la Commission de l'UA à nommer trois personnes qui n'auront la nationalité d'aucune des parties au différend, ni d'aucun des Etats du Bassin du Fleuve Nil concernés.	2. If the members nominated by the States are unable to agree on a Chairman within three months of the request for the establishment of the Commission, any State concerned may request the Chairperson of the Commission of the African Union (AU) to appoint the Chairman who shall not have the nationality of any of the parties to the dispute or of any of the Nile Basin States concerned. If one of the States fails to nominate a member within three months of the initial request pursuant to paragraph 2 of Article 33 above, any other State concerned may request the Chairperson of the AU Commission to appoint three persons who shall not have the nationality of any of the parties to the dispute or of any of the Nile Basin States concerned.
3. La Commission fixe sa propre procédure.	3. The Commission shall determine its own procedure.
4. Les Etats concernés ont l'obligation de fournir à la Commission les informations qu'elle exige et de lui permettre, à sa demande, d'avoir accès à leur territoire respectif et d'inspecter toute installation, usine, équipement, construction ou élément naturel pertinent dans le cadre de son enquête.	4. The States concerned have the obligation to provide the Commission with such information as it may require and, on request, to permit the Commission to have access to their respective territory and to inspect any facilities, plant, equipment, construction or natural feature relevant for the purpose of its inquiry.

5. La Commission adopte à la majorité des voix un rapport qu'elle soumet aux Etats concernés et qui contient ses conclusions, les motifs de ses conclusions ainsi que les recommandations qu'elle juge appropriées pour permettre la résolution équitable du différend. Les Etats concernés étudient de bonne foi le rapport de la Commission. 6. Les dépenses de la Commission sont équitablement réparties entre les Etats concernés.	5. The Commission shall adopt its report by a majority vote and shall submit that report to the States concerned setting forth its findings and the reasons therefore and such recommendations as it deems appropriate for an equitable solution of the dispute, which the States concerned shall consider in good faith. 6. The expenses of the Commission shall be borne equally by the States concerned.

Annexe sur l'Article 14(b) qui sera résolu par la Commission du Bassin du Nil endéans six mois dès son installation Aucun consensus n'ayant été trouvé à la fin des négociations sur l'Article 14(b) qui stipule : *de ne pas affecter considérablement la sécurité de l'eau de tout autre Etat du Bassin du Fleuve Nil,* tous les pays, sauf l'Egypte et le Soudan, ont accepté cette proposition. L'Egypte a proposé que l'Article 14(b) soit reformulé comme suit : *(b) de ne pas affecter défavorablement la sécurité de l'eau ainsi que sur les usages et droits actuels de tout autre Etat du Bassin du Fleuve Nil.* La réunion extraordinaire du Conseil des Ministres du Nil tenue le 22 mai 2009 à Kinshasa, République Démocratique du Congo, a décidé que l'Article 14(b) soit annexé et résolu par la Commission du Bassin du Nil endéans six mois dès son installation.	**Annex on Article 14(b) to be resolved by the Nile River Basin Commission within six months of its establishment** At the end of the negotiations, no consensus was reached on Article 14(b) which reads as follows: *not to significantly affect the water security of any other Nile Basin State*, all countries agreed to this proposal except Egypt and Sudan. Egypt proposed that Article 14(b) should be replaced by the following wording: *(b) not to adversely affect the water security and current uses and rights of any other Nile Basin State.* The Extraordinary Meeting of the Nile Council of Ministers held in Kinshasa, the Democratic Republic of Congo, on 22 May 2009 resolved that the issue on the Article 14(b) be annexed and resolved by the Nile River Basin Commission within six months of its establishment.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AGREEMENT

ON

DECLARATION OF PRINCIPLES

BETWEEN

THE ARAB REPUBLIC OF EGYPT,

THE FEDERAL DEMOCRATIC REPUBLIC OF ETHIOPIA

AND

THE REPUBLIC OF THE SUDAN

ON

THE GRAND ETHIOPIAN RENAISSANCE DAM PROJECT (GERDP)

SIGNED AT

KHARTOUM, MARCH 23, 2015

23rd March 2015 @ 11:30, Khartoum, Sudan

Agreement on Declaration of Principles between
The Arab Republic of Egypt,
The Federal Democratic Republic of Ethiopia
And
The Republic of the Sudan
On The Grand Ethiopian Renaissance Dam Project (GERDP)

Preamble

Mindful of the rising demand of the Arab Republic of Egypt, the Federal Democratic Republic of Ethiopia and the Republic of Sudan on their transboundary water resources, and cognizant of the significance of the River Nile as the source of livelihood and the significant resource to the development of the people of Egypt, Ethiopia and Sudan, the three countries have committed to the following principles on the GERD:

I. Principle of Cooperation

- To cooperate based on common understanding, mutual benefit, good faith, win-win, and principles of international law.

- To cooperate in understanding upstream and downstream water needs in its various aspects.

II. Principle of Development, Regional Integration and Sustainability;

The purpose of GERD is for power generation, to contribute to economic development, promotion of transboundary cooperation and regional integration through generation of sustainable and reliable clean energy supply.

III. Principle Not to Cause Significant Harm

- The Three Countries shall take all appropriate measures to prevent the causing of significant harm in utilizing the Blue/Main Nile.
- Where significant harm nevertheless is caused to one of the countries, the state whose use causes such harm shall, in the absence of agreement to such use, take all appropriate measures in consultations with the affected state to eliminate or mitigate such harm and, where appropriate, to discuss the question of compensation.

IV. Principle of Equitable and Reasonable Utilization

- The three countries shall utilize their shared water resources in their respective territories in an equitable and reasonable manner.
- In ensuring their equitable and reasonable utilization, the three countries will take into account all the relevant guiding factors listed below, but not limited to the following outlined:

a. Geographic, hydrographic, hydrological, climatic, ecological and other factors of a natural character;

b. The social and economic needs of the Basin States concerned;
c. The population dependent on the water resources in each Basin State;
d. The effects of the use or uses of the water resources in one Basin State on other Basin States;
e. Existing and potential uses of the water resources;
f. Conservation, protection, development and economy of use of the water resources and the costs of measures taken to that effect;
g. The availability of alternatives, of comparable value, to a particular planned or existing use;
h. The contribution of each Basin State to the waters of the Nile River system;
i. The extent and proportion of the drainage area in the territory of each Basin State.

V. Principle to Cooperate on the First Filling and Operation of the Dam

- To implement the recommendations of the International Panel of Experts (IPOE), respect the final outcomes of the Technical National Committee (TNC) Final Report on the joint studies recommended in the IPOE Final Report throughout the different phases of the project.
- The three countries, in the spirit of cooperation, will utilize the final outcomes of the joint studies, to be conducted as per the recommendations of the IPoE Report and agreed upon by the TNC, to:-
  a) Agree on guidelines and rules on the first filling of GERD which shall cover all different scenarios, in parallel with the construction of GERD.

b) Agree on guidelines and rules for the annual operation of GERD, which the owner of the dam may adjust from time to time.
c) Inform the downstream countries of any unforeseen or urgent circumstances requiring adjustments in the operation of GERD.

- To sustain cooperation and coordination on the annual operation of GERD with downstream reservoirs, the three countries, through the line ministries responsible for water, shall set up an appropriate coordination mechanism among them.
- The time line for conducting the above mentioned process shall be 15 months from the inception of the two studies recommended by the IPoE.

VI. Principle of Confidence Building

- Priority will be given to downstream countries to purchase power generated from GERD.

VII. Principle of Exchange of Information and Data

Egypt, Ethiopia, and Sudan shall provide data and information needed for the conduct of the TNC joint studies in good faith and in a timely manner.

VIII. Principle of Dam Safety

- The three countries appreciate the efforts undertaken thus far by Ethiopia in implementing the IPoE recommendations pertinent to the GERD safety.

- Ethiopia shall in good faith continue the full implementation of the Dam safety recommendations as per the IPoE report.

IX. Principle of Sovereignty and Territorial Integrity

The three countries shall cooperate on the basis of sovereign equality, territorial integrity, mutual benefit and good faith in order to attain optimal utilization and adequate protection of the River.

X. Principle of Peaceful Settlement of Disputes

- The Three countries will settle disputes, arising out of the interpretation or implementation of this agreement, amicably through consultation or negotiation in accordance with the principle of good faith. If the Parties are unable to resolve the dispute through consultation or negotiation, they may jointly request for conciliation, mediation or refer the matter for the consideration of the Heads of State/Head of Government.

This agreement on Declaration of Principles is signed in Khartoum, Sudan, on Monday the 23rd of March 2015, by the Arab Republic of Egypt, The Federal Democratic Republic of Ethiopia, and the Republic of Sudan.

For the Arab Republic of Egypt:	For the Federal Democratic Republic of Ethiopia:	For the Republic of the Sudan:
Abdel Fattah El Sisi **President of the Republic.**	**Hailemariam Desalegn** **Prime Minister of the Republic.**	**Omer Hassan Elbashir** **President of the Republic.**